THURSDAY, JULY 23, 1896.

GEOLOGY FOR STUDENTS.

The Student's Lyell; a Manual of Elementary Geology. Edited by John W. Judd, C.B., LL.D., F.R.S., Professor of Geology, and Dean of the Royal College of Science. 8vo. Pp. xxiv + 635. (London: John Murray, 1896.)

THERE are plants so deep-rooted in their native soil that time seems practically powerless to eradicate them, and even when razed to the ground, they will yet spring up again, from their tenacious hold in the heart of the earth beneath.

Thus it is with the teachings of Lyell; they have taken so strong a hold upon the minds of English geologists, that although the great historian of our science has been dead since 1875, yet his writings still illumine the path, and serve to guide full many a student who was unborn when Lyell died.

For the great "Principles of Geology," the inception of which takes us back to a far earlier period than the first edition of the "Student's Elements of Geology," indeed to more than sixty years ago, are still the guiding "principles" along which the great lines of geological thought continue to flow at the present day.

It is true that from 1858 Lyell became a thorough convert to the Darwinian theory of evolution, and, in the later editions of his works, he fully accepted the inevitable conclusions which these views involved; yet so far from weakening his hold on geological thought, the very openness of his mind proved him to be a teacher worthy to be followed and trusted, one who was able to accept new impressions and to advance, even in later life, along new lines of scientific thought.

In the work before us, we have embodied not only the survival of all that is best and fittest of Lyell's teachings, both in his "Elements" and "Principles," but also there has been superadded to the original work—by a species of "grafting" upon the parent Lyellian "stock"—a vigorous shoot from a new root—that of Prof. Judd, representing the later school of geology, as carried on in the Royal College of Science, South Kensington, formerly the Royal School of Mines, where, year after year, so many students have been trained to become geologists and to go forth to convert the wilderness into paying gold-fields, or to make geological maps of our colonies all over the world.

But much as this has added to the usefulness and up-to-dateness of the "Student's Lyell," we are reminded that other great "medicine-men" in geology have not hesitated to lend their aid to keep alive the school of Lyellian principles; and we may record that Profs. P. M. Duncan and T. G. Bonney, Mr. Etheridge, Prof. Rupert Jones, and Dr. W. F. Hume, have all helped to make this volume what it is to-day, a most useful and handy student's text-book of geology.

In spite of the expansion of the text, and the introduction into it of more than one hundred new illustrations, it has nevertheless been found possible, by using smaller type for certain portions, to avoid increasing the bulk or the cost of the volume.

Part i. embraces the introductory matter, such as the history of the development of geological science, the crust of the globe, and the nature of rocks and their classification.

The physical characters of the earth's crust, its chemical composition, and the distribution of temperature within the crust, has been entirely rewritten so as to embrace the latest information obtained by the most modern investigations.

The general relations of the stratified rocks, dealing also with the composition and classification of aqueous deposits in general, occupy the next hundred pages.

The following chapters treat of the chronology of the aqueous rocks, commencing with the Tertiary—these are disposed of in five chapters; the Secondary rocks occupy four more chapters, the Newer Palæozoic take fifty-eight pages, and the Older Palæozoic era is condensed into forty-one pages.

In dealing with the great series of aqueous or sedimentary rocks, more than five hundred figures of characteristic fossils are introduced into the text, and everywhere the importance of palæontological evidence as a means of determining the age of the rocks under consideration is pointed out; also the value of fossils as showing the earliest appearance in time of the various groups of living organisms is fully demonstrated.

Chapter xxix. gives us a general review of the sedimentary rocks; and here the student is made to understand that, as in the history of the human race, so it is with the history of the earth. In each case the later chapters are very fully and well preserved, and easily read and understood; but in both, the earlier portions become more and more fragmentary—often whole chapters are missing, and those which remain are frequently torn and mutilated.

"If we bear in mind how small must be the proportion of the relics of plants and animals now existing, that have any chance of being buried and preserved in the accumulations now being formed in seas and lakes; if we consider how remarkable must be the combination of circumstances conducing to the mineralisation of those relics, and their preservation to a remote antiquity; and if we reflect upon the remoteness of the probability of organisms, when buried and preserved by fossilisation, being exposed at the surface and found by man—we shall be on our guard against regarding the thousands and hundreds of thousands of beautiful fossils which are displayed in our museums, as representing more than a very small fraction indeed of the forms of life that have once existed on the globe" (pp. 442).

Part iii. deals with volcanic phenomena and products, with plutonic and metamorphic rocks, veins and metalliferous deposits. With this part of the work Prof. Judd must have felt, perhaps, the deepest interest, having made a special study for years of the volcanic phenomena of Europe, and given us in his volume on "Volcanoes" an excellent *vade mecum* which every student must possess.

It is interesting to know what line of thought Prof. Judd follows in reference to the assumed permanence of oceanic and continental areas; as this subject has greatly disturbed the minds of geologists of late years.

"From all that we know of the extreme slowness of the upward and downward movements which bring about even slight geographical changes, we may infer that it

ould require a great lapse of time to cause the submarine and supramarine areas to change places, even if the ascending movements in the one region and the descending in the other were continuously in one direction. But we have only to appeal to the structure of the Alps, where there are so many shallow and deep-water formations of various ages crowded into a limited area, to convince ourselves that mountain-chains are the result of great oscillations of level. High land is not produced simply by uniform upheaval, but by a predominance of elevatory over subsiding movements. Where the ocean is extremely deep it is because the sinking of the bottom has been in excess, in spite of interruptions by upheaval" (p. 124). "Movements of 1000 feet or more would turn much land into sea, and sea into land, in the continental areas and their borders; whereas oscillations of equal magniude would have no corresponding effect in the bed of he ocean generally, believed as it is to have a mean depth of nearly 13,000 feet. The greatest depths of the sea do not exceed the greatest heights of the land; it may, therefore, seem strange that the mean depth of the sea should exceed the mean height of the land six times, even taking the lowest estimate of the ocean depths as given by the late deep-sea soundings. This apparent anomaly arises from the fact that the extreme heights of the land are exceptional and confined to a small part of its surface; while the ocean maintains its great depth over enormous areas. It is evident that, during the recent periods of the earth's history, there have been great subsidences and elevations of the land; many raised beaches are 1000 to 1200 feet above sea-level. Dana, following Darwin's theory of atoll formation, terms the atoll a memorial of a departed land, and considers that the great Pacific subsidence was contemporaneous with the post-glacial upheaval in the north" (p. 123).

The volume concludes with three brief appendices, giving (*a*) a useful account of the common rock-forming minerals, (*b*) a classification of plants, and (*c*) of animals, both living and fossil.

The name of each mineral is conveniently printed in blacker type than the rest of the text, so as more readily to catch the eye. The names of the extinct orders of plants and animals are similarly printed in blacker type.

In appendix (*c*) there are a few errata, which should be corrected in a future edition. For instance, the worms of various kinds appear under two headings; nine orders being arranged in Series V. (p. 609), under Annuloidea, and four other orders have crept into Series VIII. under Arthropoda (on p. 610). On the same page "May-flies" are given as an example of Orthoptera instead of *Blatta* or *Mantis*. The Phyllocarida (represented by *Nebalia*, *Ceratiocaris*, &c.) have been accidentally omitted; also Schizopoda and Cumacea.

In the Reptilia, Proterosauria and Procolophonia are left out; and for Orthopoda, we would suggest Ornithopoda (bird-footed) as more correct. For Odontornæ (p. 612) read Odontormæ. Under Mollusca (on p. 609), by using the terms Gastropoda and Pulmonata, the student is in danger of supposing that snails are not gasteropods, whereas the Pulmonata are only a *subdivision* of the Gasteropoda.

We have only referred to this last appendix because it is stated (on p. 612) that the classification followed is that of Huxley, E. T. Newton, and Zittel; but no one would for a moment wish these authors to be held responsible for misprints which have accidentally crept into the table in its present form.

It is to be regretted that the classification of the fishes, followed by Prof. Judd, is that of Prof. Zittel, which is now considerably modified by the later arrangement (1896) of Mr. Arthur Smith Woodward. In this latest work we find that *Pteraspis*, *Cephalaspis*, *Pterichthys*, &c., are placed in a distinct division of armoured notochordal animals, the Ostracodermi; while the old division Placodermi, is broken up; the Arthrodira (*Coccosteus-like*-fishes) alone remaining. In a similar manner the Actinopterygian order has replaced the old order Ganoidei, which has disappeared.

We have already spoken in commendation of the great abundance and excellence of the illustrations (more than 700 in number) which adorn the present work; we may, however, venture to take exception to the figures of *Cephalaspis Lyelli* (p. 380) and of *Pterichthys* (p. 382). Page's figure should be replaced by the careful restoration by Prof. Ray Lankester, and Hugh Miller's *Pterichthys* by Dr. R. H. Traquair's elegant and accurate figures of that remarkable genus.

Time and space alike preclude us from doing fuller justice to this excellent text-book; but we feel assured it will live on and be read not only by many geological students, but by a large section of the English public who still hold the name of Lyell in high estimation and value his teachings. Thus will this little volume serve to keep alive the memory of one who was, perhaps, the greatest geological writer and expositor of this century.

BOULENGER'S CATALOGUE OF SNAKES.

Catalogue of the Snakes in the British Museum (*Natural History*). Vol. III. Containing the Colubridæ (Opisthoglyphæ and Proteroglyphæ), Amblycephalidæ, and Viperidæ. By George Albert Boulenger, F.R.S. Pp. xiv + 727, 25 plates. (London: Printed by Order of the Trustees, 1896.)

WITH the issue of the present volume Mr. Boulenger completes his examination and description of the herpetological collections in the British Museum, which have occupied his attention for more than fourteen years. The whole series of Catalogues thus brought to a conclusion consists of nine volumes. Two of these, issued in 1882, are devoted to the Batrachians, with the study of which Mr. Boulenger commenced his labours in our National Museum, three to the Lizards (1885–87), one to the Rhynchocephalians, Chelonians, and Crocodiles (1889), and finally three to the Snakes. The enormous series which has thus been examined, classified, and catalogued consists of 38,086 specimens. These have been referred by Mr. Boulenger to 3905 species, while 1265 others, which are allowed by the author to be valid, but are not represented in the British Museum, raise the total number of known species of Batrachians and Reptiles to 5170. While it is thus evident that our great National Institution is not without its deficiencies, there can be no doubt whatever that as regards its herpetological collections, when compared with similar institutions on the continent and elsewhere, it stands absolutely unrivalled. The collection of Reptiles and Batrachians at South Kensington is "not only the largest but also the best arranged in existence, every specimen of it having been carefully examined and classified according to a modern

system after consultation of the whole literature of the subject." Moreover, the so-called "Catalogues" are not mere lists of specimens, but, as we are assured by the Director in his preface to the last volume of the series, are "complete monographs of the groups of animals treated of, so far as their zoological characters, geographical distribution and synonymy are concerned, descriptions being given of every species regarded by the author as valid, whether represented in the Museum or not." It is not too much to say that no more arduous or more important piece of zoological work has been brought to a successful issue, in modern days, than that which has been thus accomplished by the unremitting devotion of the author of these Catalogues to his task during the past fifteen years.

With regard to the Ophidians or Snakes, which are more immediately the subject of the present notice, Mr. Boulenger has had a specially difficult subject to deal with. Next to the Lizards the Snakes are the most numerous Order of Reptiles. But while the Lizards present many well-marked characters for their division into subordinate sections, the great mass of Snakes belong essentially to one extensive group which Mr. Boulenger allows only to rank as a family. Out of the whole number of 1639 species of Snakes recognised as valid in the present work, upwards of 1250 species are referred to the Colubridæ. The proper treatment of this family is one of the most embarrassing questions for the Herpetologist. The formerly recognised division of Snakes into Venomous and Non-venomous is altogether discarded by the author, who takes the structure of the skull and other anatomical characters as his guide. The great family Colubridæ embraces venomous as well as innocuous species; indeed, the poison of some of the Proteroglyphous Colubrines (such as the Cobras and Hydrophids) is quite as deadly as that of the Vipers and Rattlesnakes. In another work, recently published, Mr. Boulenger has spoken as follows upon this subject:—

"A general desire is felt by those not well acquainted with Snakes to be able to distinguish at a glance between harmless and poisonous forms. To meet this requirement various criteria have been proposed, none of which, however, are satisfactory. It is well to state at once that there is no sure method of distinguishing the two forms by external characters, except of course a knowledge of the various forms. And even then a cursory examination is not always sufficient, since there is, in some cases, a striking resemblance between Snakes of totally different affinities, by which even specialists may be at first deceived. In short, nothing but an examination of the dentition can afford positive information as to the poisonous or non-poisonous nature of an unknown Snake."

Mr. Boulenger divides the Ophidians as a whole into nine families. He commences his systematic arrangement with the small worm-like Typhlopidæ, which pass their lives in burrows beneath the earth. They are numerous under the tropics, upwards of 100 species being already known, and many more in all probability awaiting discovery. The allied family Glauconiidæ, of which twenty-nine species are registered, has similar habits. Next to these come the Boas and Pythons (Boidæ) with sixty-six species, amongst which are the monsters of the Ophidian Order. *Python reticulatus*, of the Malay countries, is said to attain a length of thirty feet, and the Anaconda of tropical forests of South America to arrive at still larger dimensions. Of the small family Ilysiidæ, which is intermediate between the Boas and the Earth-snakes (Uropeltidæ) only five species, belonging to three genera, are known, two of these being East Indian, while one, strange to say, is South American. The Uropeltidæ, on the other hand, offer us an example of an extremely limited distribution, the whole of the forty-two known species being restricted to the mountains of Ceylon and the Indian peninsula, where they are frequently dug up in the plantations of Tea and Coffee. The sixth family of Snakes, according to Mr. Boulenger's system, consists only of the anomalous *Xenopeltis unicolor*, of India and the Malayan countries, while the seventh family, the Colubridæ, as we have already mentioned, is by far the most numerous of all, containing, in fact, more than three-fourths of all the known species of Ophidians. Mr. Boulenger divides this enormous "family" into "three parallel series"—Aglypha, Opisthoglypha, and Proteroglypha. The first of these, with solid teeth, are harmless; the last, with the anterior maxillary teeth grooved or perforated, are venomous; while the Opisthoglyphs, with the posterior maxillary teeth grooved, are all to be suspected, and usually more or less poisonous. The highly venomous Proteroglyphs are followed, although they do not lead into the typical venomous Serpents with erectile maxillary, which Mr. Boulenger unites into one family—Viperidæ—classing the Pit-vipers and Rattlesnakes only as a distinct sub-family. This is his ninth and last group of Ophidians. Between it and the Colubridæ, he locates as an eighth family the Amblycephalidæ, the members of which have but little power of expanding the mouth, and feed on insects and other small prey. Of Amblycephalidæ, thirty-four species are characterised and referred to five genera.

Whatever objections may hereafter be taken, and in some cases perhaps maintained, against Mr. Boulenger's rather revolutionary scheme of the classification of Snakes, there can be no question that his "Catalogue" makes a most distinct and remarkable advance in our knowledge of these animals, and will in future be employed by herpetologists all over the world for the arrangement of their collections, and as a solid base for future research. In the case of the "Catalogue of Birds," now nearly brought to a completion in the same zoological workshop, it has been found necessary to employ many different authors whose discordant views result in a somewhat incongruous whole. But herpetology has been more fortunate than ornithology in finding a naturalist of conspicuous ability and untiring patience who has achieved the feat of arranging and classifying all the subjects under his charge upon a uniform system.

THE MANAGEMENT OF PUBLIC WORKS IN THE UNITED STATES.

The United States Public Works Guide and Register. By Captain W. M. Black. Pp. vi + 276. (New York: Wiley and Sons. London: Chapman and Hall, 1895.)

THE public works of the United States are in charge of officers working under different bureaus of the executive departments of the Government. All harbour,

river, and dock works are carried out by the Government; the department charged with this work being under the command of a chief engineer, who, with a small staff, has his headquarters at the seat of Government; the other officers of the corps being stationed throughout the country wherever their presence is required. In the same way the lighthouses, buoys, and sea marks are under the charge of a Government department, the chief of which is the Secretary of the Treasury; the other members of the Board consisting of two officers of the Navy, two of the Corps of Engineers of the Army, two civilians of scientific attainments, with an officer of the Army and one of the Navy as secretaries. The coast is divided into districts, each under the charge of an engineer. All works in connection with fortifications and defences and military engineering are managed by the department of the Secretary of War. The quartermaster's department takes charge of all stores, transport, and military buildings; and another officer of the War department has charge of all public buildings and parks.

For the guidance of the officers of these several departments a code of regulations is drawn up as to the management and conduct of contracts, and of works performed by the department. This code provides that "the importation and migration of foreigners and aliens under contract or agreement to perform labour in the United States is forbidden." That, except in cases of extraordinary emergency, the services of labourers and mechanics employed on any public works are limited to eight hours in the day. Legal holidays for employés of the Government are January 1, February 22, July 4, and December 25. Day-workmen are paid for these days, and for such other days as may be designated days for national thanksgiving by the President. The first Monday in September, known as "Labors Holiday," is a legal holiday. In the case of contracts, all persons tendering are to be notified of the time when the tenders are to be opened, and may be present, either in person or by their agents. Any officer or agent of the Government, or any member of Congress, who receives money or other bribe in connection with any contract or work, is deemed guilty of misdemeanor, and is liable to imprisonment for a period not exceeding two years, and to be fined a sum not exceeding 10,000 dollars.

The design of Captain Black's book is to show the prescribed business methods of those of the executive departments which principally control the Government work, and to describe the nature of the works and the plant and materials most frequently required. The general laws and regulations under which all the public works are carried on are given; also a description of the departments, and of the works executed by them. Engineering principles are not dealt with, but there are numerous descriptions of works, with their cost, and illustrations of the plant used, and the method of carrying them out. These include fortifications, sea and lake shore protection works, river training works, lighthouses, public buildings, &c.

It is the practice of the Works Department of the Corps of Engineers to issue annually full reports of all works going on in the several departments. These reports are often fully illustrated, and contain numerous details as to contracts entered into, cost of the work, and results attained. Any one who is familiar with these, will at once recognise that the contents of the book are largely taken from them. This, however, in no way detracts from its value.

Although the book is written for and would be of great service to engineers in the United States, it yet contains a great deal of information respecting the works carried out in that country in training and improving rivers; and the various methods of dredging in use and the cost, and also as to the works for lighting the coast, which would be found useful and instructive to English engineers. "Suction" dredging has been much more largely used in the United States than in this country, whether as applied to the removal of sand or of clay and harder material. The methods used for disintegrating hard material, and either pumping it up by centrifugal pumps or pulsometers, or by a vacuum chamber, is fully described. In the latter case, steam is admitted to a cylinder or vacuum chamber, then condensed with cold water, the vacuum formed causing an inrush of the materials to be raised through a suction-pipe; this material is then driven out through the discharge-pipe by the admission of the steam. As an illustration of the nature of the materials this method of dredging is capable of dealing with, it is stated that a 1300 lb. stone was picked up and forced through the pipes on one occasion, and on another an iron safe measuring 25 inches by 16 inches by 14 inches.

OUR BOOK SHELF.

Wild Life of Scotland. By J. H. Crawford, F.L.S. Pp. 280. (London: John Macqueen, 1896.)

PASTORAL life has charms for a large proportion of the reading public, if one may judge from the quantity of literature dealing with its scenes and events. Perhaps the strain under which men now work in cities, has resulted in a reaction in favour of a return to nature. Certain it is that there is a demand for simple papers on subjects of outdoor natural history; and though much of the supply to meet is not above criticism, still the taste for descriptions of rural scenes and wild nature is well worth cultivation. Mr. Crawford has a passion for wild nature. He would like to rehabilitate some of the isolated hills and woodlands of Scotland with the reindeer, beaver, and wild boar; but the general opinion of his correspondents appears to be: "We cannot afford to grow wood for beavers to gnaw, or for boars to whet their tusks on." To see nature at her best in Scotland, he has gone away beyond enclosures, and has observed and judged of her ways for himself. This collection of papers, which represent the result of his observations and meditations, are typical of the forms of life in the woods and waters of Scotland; they are pleasantly written and attractively illustrated, and will interest all country naturalists.

A Cosmographical Review of the Universal Law of the Affinities of Atoms. By James Henry Loader. Pp. 93. (London: Chapman and Hall, Ltd., 1896.)

IT is a little difficult to understand the theory presented in this book. To do justice to the author, and at the same time enable readers of NATURE to appraise the contents at their proper value, we give a few extracts. It is stated that men of science have concluded "that all space must be composed of an element extremely rarefied, and that element they denominate ether." Having accepted this opinion himself, the author infers that the ether is "the primary essence of all matter, whether in a gaseous

liquid, or concrete form," which inference leads to a conclusion that seems to contain the gist of the theory advanced, and is expressed as follows. "Therefore it is reasonable to assume that this ether is composed of atoms in their normal and most rarefied state, distinct and varied in species as to their nature and substance, are unchangeable and undestructible, involved by forces of affinity from ether to a density (*sic*), and finally into a gaseous, liquid, or concrete form. And as all matter known to us is capable of being rendered volatile, either by the action of heat or potent dissolving alkalies, they are dissolved again in the course of eternity from concrete to ether." The author applies this principle of "Ether thou art, and to ether shalt thou return," very comprehensively, taking in such diverse subjects as "Nebulæ resulting in Solar Formations," "The Phenomena of the Magnet and Aurora Borealis," "The Survival of the Fittest in Protoplasmic Organisms," "Mind of Mankind," and "Rise and Fall of Nations." He also discourses freely upon "free calorics" and "latent calorics," which apparently play an important part in the scheme of involution and devolution set forth.

LETTERS TO THE EDITOR.

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of* NATURE. *No notice is taken of anonymous communications.*]

The Position of Science at Oxford.

MAY I be allowed, as one who has had some experience both within the University itself, in more than one capacity, and also in one of our public schools, to offer a few remarks on this subject?

Your recent article states that the failure of the Science School at Oxford is not complete because "it has long been recognised that the attainments of the limited number of scientific men which it turns out compare well with those of men who have been educated in other places"; while in a subsequent passage we read: "The Science School at Cambridge has acquired such a prestige that the best boys go there, and only the second best to Oxford." These two statements are either mutually opposed, or the teaching at Oxford is of so high an order that while there the "second best" are made capable of favourable comparison with those "best boys" educated elsewhere. "Failure" is hardly an apt description of such an achievement. In my opinion Oxford gets its full share of "best boys." I can quote instances of boys of second-rate ability who have gained scholarships at Cambridge, but would have failed to do so at any college at Oxford. The standard required by Oxford is undoubtedly a higher one than that which is sufficient at many (not all) Cambridge colleges; and, as a rule, the value of Oxford scholarships is correspondingly greater. In my experience the character of the Final Honour Schools of Science at Oxford is such that a boy of brilliant attainments and originality is more benefited by the course there prescribed, than by the wider but shallower training of Part I. of the Science Tripos. It is my practice to endeavour to send such boys to Oxford, and hitherto there has been no cause for repentance. The prestige of the Cambridge Medical School is undoubtedly a great obstacle to the increase in numbers (if indeed this is to be desired) of science students at Oxford. London and Cambridge practitioners far outnumber all others, and it is to one of these that the parents of boys who give evidence of scientific tastes, turn for advice regarding their sons. Can it be wondered that the advice given is generally in favour of some school other than at Oxford? Until the general public realises that, alike in pure science and in medicine and surgery, Oxford can and does hold her own with other places of education, the number of Oxford students will remain small.

I believe, however, that many staunch friends of Oxford hold with me, that a small school of high standard is more in accordance with her best interests, than a large one in which applied science stifles the acquirement of knowledge for its own sake.

You pronounce, on the whole, against Greek as a compulsory subject. Does any scientific man who has learnt, be it never so little, Greek, regret the time spent upon it? In teaching elementary science, especially biology, it is brought home to the teacher that technical terms form a serious stumbling-block to many boys; but if the classical derivation of these words is mentioned, they at once cease to be difficulties, and become readily familiar. The Greek language is called into service in so many of these modern terms, that ignorance of Greek cannot fail to materially increase the obstacles that beset the path of the beginner. This is perhaps a low ground on which to argue in favour of Greek, but it is one that is too frequently entirely overlooked by its opponents.

"On the whole, the teaching in public schools is bad." One of the accused can hardly reply impartially to such a charge, but I fully agree with the half-acquittal implied in the subsequent query: "Are the public schools altogether to blame?" Science labours under heavy disadvantages at most public schools. The *genius* of the schools is classical. The value attached to science is so small, that even a promising boy cannot make up by his science for deficiency in classics or mathematics, and thus is condemned to pass his days in the lower part of the school; whereas the acute classic, however obtuse in science, is in no way hindered on his path to the sixth form. Promotion is on the aggregate of marks, and the proportion allotted to science is insignificant. Classes are arranged by aggregate merit, and a graduated series of science classes grouped according to scientific ability is almost unknown. A scientific subject added to responsions would probably improve matters; but it must be remembered that some minds are so constituted (I speak from experience and mature conviction), that scientific subjects are to them of no educational value whatever, and a compulsory examination in science would prove an impediment to many a brilliant classic whose progress we should do ill to bar. If, however, such an examination were to act in a downward direction, and cause public schools to include science in their entrance and scholarship examinations, it would indeed serve a good purpose. Few preparatory schools include science in their curriculum; their whole energy is devoted to those subjects which will bring a substantial return of advertising value in the form of a scholarship. Experience has shown me in an unmistakable way that boys who have gone through the entrance scholarship mill have, in most cases, had all aptitude for science crushed out of them, and that they require a course of mentally-invalid treatment before any of them recover a healthy tone and attitude of mind towards a subject of which they have been hitherto kept in ignorance. These boys are presumably the pick of their contemporaries in general ability, and at present these keener intellects are debarred from exercise in scientific subjects, for which assuredly some few would exhibit a preference.

In a guarded expression you give your vote to the study of physics and chemistry in schools. This view is one very generally held; but I believe it to be wrong, and an inversion of the natural order. Our object, I take it, is to draw out and develop in our pupils those talents that they severally possess. Boys are outdoor beings, and they should be so; nearly every boy at some period of his life collects insects, bird's eggs, or flowers. It is this collecting instinct which ought to be converted by education into the observing habit, and so made a natural foundation on which to erect a truly scientific superstructure of acquired knowledge. More boys are interested and intellectually stimulated by subjects touching on natural history than by physics and chemistry. These last not infrequently repel at first, whereas the others can to a certain extent be pursued on the play-fields and in the surrounding country. The pupil soon finds that he must acquire some knowledge of physics and chemistry; and the want being felt, the task is more willingly undertaken. In this connection I must state my belief that the present style of examination for science scholarships at both Universities does not give sufficient opportunity to the "boy naturalist," and indeed the majority of boys who become scholars are not "naturalists" in any sense. Many colleges have in this respect materially improved their examinations recently, and the change is beginning to bear fruit; but until it is more widely recognised that the boy naturalist is the parent of the man scientific, so long will many minds, by nature best suited to extend our knowledge, be diverted into unnatural and less fertile channels. OSWALD H. LATTER.

Charterhouse, Godalming, July 13.

IN your issue of July 9 there is an article on "The Position of Science at Oxford," and though I am not very well acquainted with that position, and am entirely in sympathy with the writer in his endeavour to get that University to encourage the science student more than it does, yet there are some remarks in the article to which I must take exception.

The statement that men of a year's standing at Cambridge, who come up with a moderate acquaintance of science, have an opportunity of bringing themselves up to scholarship standard at the end of their first year, sounds rather as if this was of importance in attracting the science student to Cambridge. But is this opportunity really of importance? Do many men in reality get scholarships in science at the end of their first year? Is not the scholarship money rather used in increasing the value of the scholarships already gained, than in forming new ones? Are not those who go up with "a fair general education and only a moderate acquaintance with science," more often advised by their college tutor to go in for the general examination than to specialise in science at once?

But after making the above statement, unsupported by statistics, the writer goes on to make an onslaught on science teaching at our public schools as the cause of the inferiority of the science student at Oxford.

Taken as a whole, he says the science teaching at our public schools is bad. The arguments he brings forward to support this statement are that, firstly, the inducements offered to learning science are very few; secondly, it is openly discouraged; and thirdly, boys neglect those studies which may safely be neglected. He seems to try, moreover, to prove the absence of good science teaching by the fact that the average boy comes up to the university destitute of scientific ideas. Let us take these points separately. The teaching is bad because the inducements to learning science are nil. This will be news to many who spend their lives in teaching science. What are the inducements to learn anything? At an early age two, at least, of the inducements to learn are interest and fear. Now the interest taken by the average boy in learning about the things around him—the earth, the air, plant or animal life—is undeniable, and it is far easier to get him interested in events which occur in the natural world than in G.C.M. or *Mensa*. While if fear is to be called on as an inducement, it is as easy to cane him for not doing his science work as it is to cane him for neglecting his classics. But later in life a boy begins to think of his future; and if he chooses a career in which a knowledge of science will help him, it will be just as great an inducement to work hard at science as it would be to work hard at classics if he had chosen a career in which classical learning was of importance. Still later he may learn to look at learning for its own sake, and he will feel that if he has a bent towards science, he will be able to educate himself by working hard at science, just as if he had a bent towards any other study he would be induced to work hard at that particular study. So that the statement that the inducements offered to the study of science are very few, is a somewhat extraordinary one to make.

Secondly, the statement that learning science is openly discouraged is, happily, becoming a false one. There are few of our public schools now that are not doing a great deal of science teaching; and though it is to be hoped that science teaching will spread still more, yet one must gladly acknowledge the enormous advance of science teaching during the past decade, and must feel that the open discouragement of science is now no longer in existence.

But what shall be said of the argument that the product of public school science teaching is a failure because boys neglect those studies which may safely be neglected? This is a direct attack on the science teachers at all our public schools as being inefficient teachers, and is an argument for calling on all headmasters to dismiss their present staff of science teachers. Before accepting this conclusion it would be of interest to know who your correspondent is, that one might know what sort of authority he speaks with, and what knowledge he has of the science teaching at the public schools. Moreover these schools, with their absence of inducements to learning science, and their absence of efficient teachers in that subject, send science scholars in large numbers to Cambridge.

But the final argument that science teaching at the public schools is bad, is because the average schoolboy comes up to "the University" destitute of scientific ideas. There is no clue to what he means by "the University"; but, taking Cambridge as an example, a considerable percentage of its undergraduates who go in for an honours degree, take up the Natural Science Tripos, a large number go in for medicine, and others go in for the study of science in order to get an ordinary degree. Most of these have done a considerable amount of science at school, and cannot be said to be destitute of scientific ideas. But many of the others, who go in for classics, mathematics, or other studies, although they may not remember the equation representing the action of sulphuric acid on chalk, yet, if they have been taught elementary science in their youth, may have learnt from it some of the accuracy and method which should characterise their work in any direction; while the training given to the mind in forcing it to appeal from written words or spoken statements to experimental facts is of immense importance, even though the particular facts may themselves be forgotten.

But the cry that Oxford is not attracting the science student in large numbers, is no doubt true; and the reason is to be sought inside, not outside, her walls. Cambridge, it is confessed, is not in the like predicament; and Cambridge has attracted many, who would not otherwise have gone to a university at all, by her medical and engineering schools.

A vast number of boys who do science at school, go straight to the hospitals or to technical institutions; and if Oxford is to attract the science student, she must develop that side of her teaching.

C. I. GARDINER.

Cheltenham College.

Capture of a Specimen of "Lepidosiren" in the River Amazons.

I HAVE just received a letter from Dr. Émil Goeldi, Director of the rising Museum at Pará, in which he informs me of the interesting discovery of *Lepidosiren* at the mouth of the river Amazons (or rather of the river Tocantins). I had better give the part of his letter which refers to this capture. The letter is dated Pará, June 9.

"I have the pleasure of informing you of the discovery of *Lepidosiren* at the mouth of the river Amazons, viz. on the island Marajó. This afternoon I received, from a friend who has large possessions in the island, a specimen in spirits. The mail leaves in a few hours, so that I can scarcely do more than send you a few lines announcing this fortunate event.

"Often, since my arrival in Brazil, has my attention been directed to the search for this Dipnoan, especially by Prof. Karl Vogt and yourself. But it was only after my appointment to the Pará Museum, that I could take up the matter with a reasonable hope of success. I began with distributing thousands of copies of Natterer's figure in reduced size all over Amazonia, and sending paragraphs to the local newspapers in the interior. No local magistrate, no village schoolmaster escaped a notice.

"In consequence of this propaganda I received about a year ago a communication from Dr. Vicente Chermont de Miranda, who takes a great interest in all scientific matters; he informed me that the fish occurs in Marajó, and that he had seen already two specimens. The specimen sent to me now is therefore the third which has come under his notice. It measures, in the present state of preservation, about 58 cm., and is of a slate-colour. The ovaries are well developed, and show that the specimen was killed close to the spawning-time. No villi on the hind-limbs; vent asymmetrical, on the left side; greatest width of body 7 cm. Well acquainted with Ehlers's and Lankester's papers on *Lepidosiren paradoxa* and *articulata*, I looked immediately to the structure of the fin-cartilage. Its segmentation can be seen even without removing the skin, as figured in Lankester's memoir (Fig. 4). Therefore, our Amazons-specimen might be called *articulata* on the same ground as the Paraguay specimens collected by Bohls. But I agree with you and Prof. Lankester that there is one species only of *Lepidosiren*, viz. *L. paradoxa*—*L. dissimilis, gigliona, articulata* being synonyms.

"The exact locality for our specimen is Fazenda 'Dunas,' on Cape Magoary, Island of Marajó.

"One word more: Prof. Lankester speaks of five Amazons-specimens in European museums. I believe there are six. Only a few years ago the late Mr. Gustav Toepper obtained a specimen near Itaituba on the Tabajóz River which, as I have been credibly informed, has found its way into the Berlin Museum."

ALBERT GÜNTHER.

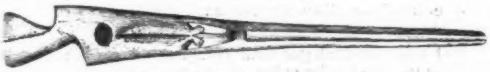
Eskimo Throwing-Sticks.

I SEND you herewith a drawing of a throwing-stick which was brought to Washington by Captain John Rodgers, U.S.N., of the *Vincennes*, who explored the Behring and the Arctic Seas from 1850–55.

In my paper on the "Throwing-Stick" (Rep. U.S. National Museum, 1884, pl. vi.), this is figured as the Rodgers specimen, locality unknown. Subsequently, M. Adrien de Mortillet produced in the *Revue Mensuelle de l'École d'Anthropologie* (viii. p. 246) a figure of a similar apparatus. Since then Mr. Walker Clark, of Edinburgh, Scotland, has sent me photographs of the same type from the Edinburgh Museum, and apparently associated with Beechey's explorations.

Dr. Franz Boas calls my attention to specimens of the same type in the American Museum in New York. The U.S. National Museum has also similar objects collected by Mr. Jas. G. Swan and the Rev. Vincent Colyer.

I have ascertained, by searching the records, that Captain Rodgers touched at Unalashka and collected specimens at that



place belonging to Kadiak, Cook's Inlet, and Prince William's Sound. Putting all the information together it is now my opinion, confirmed by that of Dr. Boas, that all of these examples are from Prince William's Sound. This belief is confirmed also by the fact that these are the only Eskimo throwing-sticks which show carving in relief on the back. They seem to be all made of hard spruce, and by their markings to be allied to those of the more elaborately carved specimens from Sitka in the British Museum, the United States National Museum, and elsewhere. The front or top side of the specimen has a fine ivory point for the butt end of a delicate sea otter, barbed harpoon, and a shallow groove only half its length. The finger pocket does not extend quite through to the top side.

OTIS T. MASON.

U.S. National Museum, Washington, June 25.

The Salaries of Science Demonstrators.

THE enclosed fable, possibly from a missing edition of Kingsley's "Water Babies," seems to have some remote connection with the heading that has been affixed to it. O. J. L.

An aggrieved tadpole once found its way as a deputation to Mother Carey, and complained as follows, at first reading from a document, but afterwards becoming more eloquent and expressive :—

"We, your industrious and not unworthy subjects, desire to lay before you our wrongs. We cannot get out on to the land and attend meetings as the frogs do, and consequently we get no flies; yet it is we who do all the work of the pond. The frog only looks in now and then; and even if he had a mastermind (which he hasn't), his visits would have no effect. He croaks, that's what he does; he sits on the bank and eats flies, and he croaks, and so he gets listened to. As for us, we are treated no better than sticklebacks or minnows; why, there's a bloated travelling newt, who gets twice as much as we do. It's all because you old fogies are accustomed to croak yourselves. It's all——"

"And what prospects have the minnows and sticklebacks?" here interrupted the dame. "When do they hope to leave the pond and gain advancement?"

"Why, never, of course; they've got all they'll ever get, and too much at that," grumbled the tadpole.

"And do you also intend to remain in your present condition always?"

"Not I: I intend to become a frog, and hop about, and attend meetings, and catch flies, and make a noise in the world."

"Yes; and, meanwhile, you would like these desirable appurtenances of the frog state diminished? Remember your whole pond is but a recently banked-up affair—on rather sandy soil, and the margin is narrow; it might run empty unexpectedly, you know."

"I don't care," ejaculated the tadpole; "cut off the water, and then we shall all be on dry land together; anything better than the present inequality."

"Very well," said the dame; "I know some creatures in a state of probation, not long out of the egg, who actually have to pay for the privilege of practising their future career. However, your wish that one of the recently-dug supply channels shall be stopped, so that your pond may run dry enough to let you also touch solid land as your predecessors have otherwise done, is so simple and easy to carry out, that perhaps it can be managed. Fare thee well."

A Curious Rainbow.

WHILST enjoying a general survey of the sky this evening I was giving my attention more particularly to an expanse of brilliantly white cirrus cloud, unusually complicated in its detail, when, at 7 p.m., a small inverted rainbow suddenly became apparent along the front margin of this cloud (now approaching the zenith from W.S.W.).

The bow, at first, just spanned the width of the cloud upon which it was projected, but as it increased its length a little at its "left," or south-western extremity, and as the cloud drifted slightly to "right," or north of eastwards, the bow was at last wholly projected upon a background of (apparently) clear blue sky. This last effect was extremely beautiful; the bow being so brilliantly coloured that it would, I think, hardly have escaped my notice, even if I had not first seen it upon the background of white cloud.

There was a perfect sequence of all the prismatic colours from the red, below, to the violet, above—and the curvature of the bow was remarkably rapid—and extending not more than about 2° in length.

It remained visible for about 5 or 7 minutes.

If any one can furnish me, through the medium of your columns, with an explanation of this peculiarly beautiful phenomenon, and in language that can be "understanded of the people," I shall be greatly obliged. C. O. STEVENS.

Barnet, July 12.

Effect of Lightning.

ON Tuesday, July 7, a violent storm passed over this district, and three balls of fire have been reported. Two trees were splintered, and two sheep were struck by lightning on the downs.

One sheep was not seriously injured, but the other was killed; on being struck, both sheep turned over on their backs. The one fatally injured was struck on the top of the head, the lightning passing down the animal's right jaw on to its breast; here it divided into three, and passed down both fore-legs and under the stomach. The course of the lightning on the wool was like the track of a red-hot poker. After death the aft part and belly of the sheep were greatly distended, as if with air. The blood appeared to have rushed from the head to the rear of the animal at the moment of death, for, on skinning the sheep, the neck part was found to be destitute of blood, whilst a considerable amount of blood was under the skin of the back, as if blood had escaped to that position. The sheep's mouth was distorted by being drawn aside. Close to the sheep's fore-feet a hole was made in the ground by the lightning, about the size of a quart jug. WORTHINGTON G. SMITH.

Dunstable.

A Brilliant Meteor.

I HAD the pleasure on Friday evening last, the 16th inst., o observing a brilliant meteor from a point about half-way between the towns of Blaenau and Llan Festiniog. The time was 9.10 p.m., the sky quite clear, and not dark enough for any stars to appear. The meteor appeared almost due south of my position, the length of its path being an arc of about 20°, disappearing a short distance above the horizon, and lasting about four seconds. Very little trail could be seen, as it was practically daylight. The colour appeared of a bluish tinge, and the meteor appeared to become brighter in the middle of its path.

C. H. H. WALKER.

County School, Blaenau Festiniog, July 19.

THE INTERNATIONAL CATALOGUE CONFERENCE.

THE preliminary proceedings of the Conference organised by the Royal Society to consider the preparation and publication of an International Catalogue of Scientific Literature, were reported in last week's NATURE. The Conference was brought to a conclusion on Friday, and we are now able to give the official report of the Acta in the three languages in which it is indited. From this report it will be seen that the Conference has laid a sound basis for the greatest scientific bibliography ever contemplated. The Royal Society is to be warmly congratulated upon the initiative it has taken in the matter, and the whole scientific world will be gratified at the international spirit shown in the subjoined resolutions —a spirit which prevailed throughout the Conference.

Opening Meeting, Tuesday, July 14, 1896, 11 *a.m., at the Rooms of the Royal Society, Burlington House.*

The resolutions prepared by the International Catalogue Committee of the Royal Society to serve as a basis for discussion were taken into consideration, and the following resolutions were agreed to *nemine contradicente*:—

(12) That it is desirable to compile and publish by means of some international organisation a complete catalogue of scientific literature, arranged according both to subject-matter and to authors' names.

Qu'il est désirable de compiler et de publier à l'aide d'une organisation internationale un catalogue complet de littérature scientifique classé suivant les sujets et les noms des auteurs.

Es ist wünschenswert vermittelst einer internationalen Organisation einen vollständigen Katalog der wissenschaftlichen Litteratur zusammenzustellen und zu veröffentlichen, geordnet sowohl nach dem Inhalt als auch nach den Namen der Verfasser.

(13) That in preparing such a catalogue regard shall, in the first instance, be had to the requirements of scientific investigators, to the end that these may, by means of the catalogue, find out most easily what has been published concerning any particular subject of inquiry.

Qu'en préparant le catalogue on aura avant tout égard aux besoins des travailleurs scientifiques afin que ceux-ci puissent à l'aide de ce catalogue trouver facilement ce qui a été publié concernant les recherches sur quelque sujet que ce soit.

Bei der Vorbereitung eines solchen Katalogs soll in erster Linie Rücksicht genommen werden auf die Bedürfnisse wissenschaftlicher Forscher, so dass dieselben mit Hülfe dieses Katalogs sich leicht in der Litteratur über irgend einen besondern Gegenstand der Forschung orientiren können.

(14) That the administration of such a catalogue be entrusted to a representative body, hereinafter called the International Council, the members of which shall be chosen as hereinafter provided.

Que l'administration d'un tel catalogue soit confié à un corps représentatif, sous le nom de *Conseil International*, dont les membres seront choisis d'après les décisions prises ultérieurement.

Die Administration eines solchen Katalogs soll einer repräsentativen Körperschaft übertragen werden (die weiterhin "the International Council" genannt wird) deren Mitglieder in einer später zu bestimmenden Weise gewählt werden sollen.

(15) That the final editing and the publication of the catalogue be entrusted to an organisation, hereinafter called the Central International Bureau, under the direction of the International Council.

Que l'édition définitive et la publication du catalogue soient confiées à une organisation nommée plus tard le *Bureau Central International* sous la direction du Conseil International.

Die Herausgabe und Veröffentlichung des Katalogs soll, unter der Leitung des International Council, einer Organisation anvertraut werden, die hier "Central International Bureau" genannt wird.

(16) That any country which shall declare its willingness to undertake the task shall be entrusted with the duty of collecting, provisionally classifying, and transmitting to the central Bureau, in accordance with rules laid down by the International Council, all the entries belonging to the scientific literature of that country.

Que l'on charge chaque pays, qui se déclarera prêt à entreprendre cette tâche, de collectionner, de classer provisoirement, et de transmettre au Bureau Central selon les règles formulées par le Conseil International, tous les matériaux necessaires pour la bibliographie de la littérature scientifique de ces pays.

Jedes Land welches sich bereit erklärt, an der Arbeit theilzunehmen, soll mit der Aufgabe betraut werden, in Uebereinstimmung mit den von dem International Council vorgeschriebenen Regeln, das Material über alle einschlägigen wissenschaftlichen Veröffentlichungen des betreffenden Landes zu sammeln, provisorisch zu klassifiziren und dem centralen Bureau zu übermitteln.

(17) That in indexing according to subject-matter regard shall be had, not only to the title (of a paper or book), but also to the nature of the contents.

Que dans le classement du catalogue d'après la nature des sujets, on aura égard non seulement aux titres d'un article ou d'un livre, mais aussi à la nature de son contenu.

Bei der Aufzeichnung der Abhandlungen und Bücher soll nicht nur der Titel derselben sondern auch der Inhalt berücksichtigt werden.

(18) That the catalogue shall comprise all published original contributions to the branches of science hereinafter mentioned, whether appearing in periodicals or in the publications of Societies, or as independent pamphlets, memoirs, or books.

Que le catalogue comprendra toutes les contributions originales aux différentes branches de la science telles qu'elles sont mentionnées ci-après, paraissant soit dans les revues, ou dans les publications des sociétés, ou comme brochures indépendantes, mémoires, ou livres.

Der Katalog soll alle Original-Abhandlungen aus den weiter unten angeführten Wissenszweigen umfassen, gleichviel ob dieselben in Zeitschriften oder in Veröffentlichungen von Vereinen erschienen sind, oder in Form von Flugschriften, selbständigen Aufsätzen oder Büchern.

Second Meeting, Wednesday, July 15, 1896, 10 *a.m., at the Rooms of the Royal Society, Burlington House.*

(19) It having been proposed—

That a contribution to science for the purposes of the catalogue be considered to mean a contribution to any of the mathematical, physical or natural sciences, the limits of the several sciences to be determined hereafter—

Que devront entrer dans le catalogue toutes les contributions aux sciences mathématiques, physiques ou naturelles, les limites des différentes sciences étant détérminées ultérieurement.

In den in Rede stehenden Katalog sollen alle wissenschaftlichen Beiträge zur Mathematik und zu den Naturwissenschaften aufgenommen werden; die Abgrenzung der verschiedenen Wissenschaften ist weiterhin festzustellen.

The following amendment was moved, and, after discussion, adopted:—

That the terms of the resolution be referred to a Committee, consisting of Messrs. Armstrong, Billings, Darboux, Korteweg, Möbius, and Schwalbe, to report to the Conference at the opening meeting, on July 16.

The following resolutions were then agreed to *nemine contradicente*:—

(20) That in each country the system of collecting and preparing material for the catalogue shall be subject to the approval of the International Council.

Que la méthode employée pour réunir et préparer le matériel du catalogue dans chaque pays sera soumise à l'approbation du Conseil International.

Es soll das System, nach welchem das Material für den Katalog in jedem Lande gesammelt und vorbereitet wird, der Zustimmung des Internationalen Ausschusses unterworfen sein.

(21) That in judging whether a publication is to be considered as a contribution to science suitable for entry in the catalogue, regard shall be had to its contents, irrespective of the channel through which it is published.

Que pour juger si une publication doit être considérée comme propre a être admise dans le catalogue, on aura égard à son contenu, indépendamment du lieu et de la forme de la publication.

Bei der Beurthellung, ob ein Beitrag zur Eintragung in de

Katalog geeignet ist, soll der Inhalt berücksichtigt werden, ohne Rücksicht auf den Ort oder die Art der Veröffentlichung.

(22) That the Central Bureau shall issue the catalogue in the form of "slips" or "cards," the details of the cards to be hereafter determined, and the issue to take place as promptly as possible. Cards corresponding to any one or more branches of science, or to sections of such sciences, shall be supplied separately at the discretion and under the direction of the Central Bureau.

Que le Bureau Central éditera le catalogue sous la forme de fiches, le détail des fiches devant être déterminé ultérieurement, et la publication devant avoir lieu le plus promptement possible ; les fiches relatives à une ou plusieurs sciences ou à l'une des sections de ces sciences seront fournies séparément au publie sous la discretion et à la direction du Bureau Central.

Das Central-Bureau soll den Katalog in der Form von "Papierstreifen" oder "Karten" ausgeben ; die Details für diese Karten sollen später näher bestimmt werden ; die Ausgabe soll so rasch als möglich geschehen ; Karten, welche zu der einen oder andern Wissenschaft, oder zu Abtheilungen derselben gehören, sollen mit Zustimmung und auf Anordnung des Central-Ausschusses separat verabfolgt werden.

(23) That the Central Bureau shall also issue the catalogue in book form from time to time, the entries being classified according to the rules to be hereafter determined.

That the issue in the book form shall be in parts corresponding to the several branches of science, the several parts being supplied separately, at the discretion and under the direction of the Central Bureau.

Que le Bureau Central publiera, de temps en temps, le catalogue sous le forme de livre, les titres étant classés selon les règles qui seront déterminées ultérieurement.

Que la publication sous forme de livre sera divisée en parties correspondant aux diverses branches des sciences, les diverses parties pouvant être fournies séparément, sur demande.

Das Central-Bureau soll auch, von Zeit zu Zeit, den Katalog in Buchform herausgeben und sollen die Titel nach weiterhin zu bestimmenden Regeln klassifizirt werden.

Die Herausgabe in Buchform soll in Abtheilungen geschehen, welche den einzelnen Wissenschaften entsprechen, und sollen die Theile auf Verlangen einzeln verabfolgt werden.

(24) General Ferrero having moved

That the Central Bureau be located in London—

The resolution was seconded by M. Darboux, supported by Messrs. Möbius, Heller, Weiss, Simon Newcomb, Otlet, Duka, Bourcart, Dahlgren, and Korteweg, and accepted by acclamation.

Third Meeting, Thursday, July 16, 1896, *at the Rooms of the Royal Society, Burlington House.*

The appointment of Prof. Liversidge, F.R.S., as official delegate representing New South Wales, was notified.

(25) The following resolutions were agreed to *nemine contradicente*:—

That a contribution to science for the purposes of the catalogue be considered to mean a contribution to the mathematical, physical, or natural sciences, such as, for example, mathematics, astronomy, physics, chemistry, mineralogy, geology, botany, mathematical and physical geography, zoology, anatomy, physiology, general and experimental pathology, experimental psychology and anthropology, to the exclusion of what are sometimes called the applied sciences—the limits of the several sciences to be determined hereafter.

Devront entrer dans le catalogue toutes les contributions aux sciences mathématiques, physiques, et naturelles ; par exemple : Mathématique, astronomie, physique, chimie, minéralogie, géologie, géographie mathématique et physique, botanique, zoologie, anatomie, pathologie générale et expérimentale, psychologie expérimentale, physiologie et anthropologie, à l'exclusion de ce qu'on nomme parfois sciences appliqués ; les limites des différentes sciences seront déterminées ultérieurement.

In den in Rede stehenden Katalog sollen alle Beiträge zur Mathematik und zu den Natur-Wissenschaften aufgenommen werden, wie (z. B.) zur Mathematik, Astronomie, Physik, Chemie, Mineralogie, Geologie, zur Mathematischen und Physikalischen Geographie, zur Botanik, Zoologie, Anatomie, Physiologie, Allgemeinen und Experimental-Pathologie, Psychophysik und Anthropologie, unter Ausschluss der sog. angewandten Wissenschaften ;—wobei die Abgrenzung der einzelnen Gebiete noch in der Folge festzulegen ist.

(26) That the Royal Society be requested to form a Committee to study all questions relating to the catalogue referred to by the Conference, or remaining undecided at the close of present sittings of the Conference, and to report thereon to the Governments concerned.

La Société Royale est priée de créer une Commission ; celle-ci sera chargée d'étudier toutes les questions relatives au Catalogue, qui lui sont renvoyés par la Conférence et celles qui n'ont pas été résolues définitivement dans la Conférence, et de faire rapport sur le sujet aux gouvernements intéressés à l'entreprise.

Die Royal Society wird ersucht, ein Comité zu bilden, mit dem Auftrag, alle Fragen, welche ihr von der Conferenz vorgelegt werden und alle welche noch nicht definitiv festgelegt sind, auszuarbeiten und darüber an die beteiligten Regierungen zu berichten.

(27) Since it is probable that, if organisations be established in accordance with Resolution 16, the Guarantee Fund required for the Central Bureau can be provided by voluntary subscriptions in various countries, this Conference does not think it necessary at present to appeal to any of the Governments represented at the Conference for financial aid to the Central Bureau.

L'organisation prévue à la résolution 16 rendant probable que le fonds de garantie nécessaire au Bureau Central pourra être fourni par des souscriptions particulières dans différents pays, la Conférence estime qu'il n'est pas indispensable pour le moment de faire appel à l'aide financière des Gouvernements intéressés.

Insoferne voraussichtlich Einrichtungen im Sinne von Resolution 16 getroffen werden, erscheint es möglich, einen Garantiefonds für das Centralbureau durch freiwillige Zeichnung in den verschiedenen Ländern aufzubringen, und es glaubt daher die gegenwärtige Conferenz dass es zur Zeit nicht notwendig für das ist Centralbureau die finanzielle Unterstützung irgend einer der bei der Conferenz vertretenen Regierungen in Anspruch zu nehmen.

Fourth Meeting, Friday, July 17, 1896, *at the Rooms of the Royal Society, Burlington House.*

The following resolutions were agreed to *nemine contradicente*:—

(28) The Conference being unable to accept any of the systems of classification recently proposed, remits the study of classifications to the Committee of organisation.

Le Conférence ne pouvant accepter aucune des systèmes de classification récemment proposés renvoie l'étude des classifications au Comité d'organisation.

Die Conferenz kann keine der verschiedenen in der letzten Zeit vorgeschlagenen Classifications-Systemen annehmen und überträgt desshalb die Ausarbeitung von Classificationen dem Organisations-Comité.

The Belgian delegates expressly desired that it be placed on record that they abstained from voting on this resolution.

(29) That English be the language of the two catalogues, authors' names and titles being given only in the original languages except when these belong to a category to be determined by the International Council.

L'anglais sera la langue des deux catalogues. Toutefois les noms d'auteurs et les titres des mémoires seront donnés seulement dans la langue originale à moins que cette langue n'appartienne à une catégorie qui sera déterminée par le Conseil International.

Es soll Englisch die Sprache der beiden Cataloge sein. Die Namen der Verfasser und die Titel sollen indessen ausschliesslich in der Original-Sprache veröffentlicht werden, ausgenommen in den von dem Internationalen Ausschuss zu bestimmenden Fällen.

(30) That it be left to the Committee (of the Royal Society) to suggest such details as will render the catalogue of the greatest possible use to those unfamiliar with English.

Le Comité aura à proposer tous les détails qui seraient de nature a rendre plus facile l'usage du catalogue dans les pays de langues étrangères à la langue anglaise.

Es wird dem Comité der Royal Society überlassen, alle Anordnungen zu treffen welche den Gebrauch des Cataloges für die nichtenglischen Sprachen zu erleichtern geeignet sind.

(31) That it is desirable that the Royal Society should be informed, at a date not later than January 1, 1898, what steps (if any) are being taken, or are likely to be taken, in the countries whose Governments are represented at the Conference, towards establishing organisations for the purpose of securing the end had in view in Resolution 16.

Qu'il est désirable que la Société Royale reçoive communication, au plus tard le 1[er] janvier, 1898, des démarches qui ont été prises ou seront prises par les gouvernements des pays représentés à la Conférence pour l'exécution de la résolution 16.

Es ist wünschenswerth, dass die Royal Society nicht später als bis zum 1. Januar 1898, darüber verständigt werde, welche Schritte von Seiten der Ländewelche Delegirte zur Versammlung gesendet haben gethan oder in Aussicht genommen sind, um Einrichtungen zu treffen welche die Durchführung des Beschlusses 16 ermöglichen.

(32) That the Delegates, in reporting to their respective Governments the Proceedings of the Conference, should call immediate attention to Resolutions 16 and 31.

Que les délégués sont invités en faisant rapport à leurs gouvernements à attirer spécialement l'attention sur les résolutions 16 et 31.

Die Delegirten wollen in den Berichten an ihren Regierungen über den Verlauf der Versammlung, die besondere Aufmerksamkeit auf die Beschlüsse 16 und 31 lenken.

(33) That January 1, 1900, be fixed as the date of the beginning of the catalogue.

Que le début du catalogue soit fixé au 1[er] janvier, 1900.

Es soll der 1. Januar 1900 als Datum für den Anfang des Cataloges festgesetzt werden.

(34) That the Royal Society be requested to undertake the editing, publication, and distribution of a verbatim report of the Proceedings of the Conference.

La Société Royale est prié de se charger de la confection, de la publication, et de la distribution d'un compte rendu textuel des travaux de la Conférence.

Die Royal Society wird ersucht, die Abfassung, Veröffentlichung und Versendung eines wörtlichen Berichtes der Verhandlungen der Conferenz zu übernehmen.

(35) That the *procès verbal* of the Conference be signed by the President and Secretaries.

(36) That this Conference requests the Royal Society to express to the Lord Mayor of London and to Dr. L. Mond their grateful, hearty appreciation of the hospitality shown by them to the Delegates.

(37) On the motion of M. Darboux, a vote of thanks to Sir John Gorst, for presiding over the Conference and his conduct in the chair, was passed by acclamation.

(38) On the motion of Prof. Weiss, a vote of thanks to the Royal Society, for their cordial reception of the Delegates, was unanimously carried.

Signed { JOHN E. GORST, President.
HENRY E. ARMSTRONG
WALTHER DYCK
F. A. FOREL } Secretaries.

ARCHÆOLOGICAL STUDIES IN MEXICO.

MR. WILLIAM H. HOLMES, who has been so long and favourably known in connection with the Smithsonian Institute at Washington, has lately been placed in charge of the Department of Anthropology at the Field Columbian Museum at Chicago, and has now issued from his department the first volume of what promises to be a most interesting series of anthropological publications.

Soon after Mr. Holmes had moved to his new post, Mr. Alison Armour, of Chicago, who takes a keen interest in archæological studies, invited (to quote from Mr. Holmes's preface) a number of "gentlemen representing different branches of scientific research to accompany him in his steam yacht *Ituna* on a voyage to Mexico. Three months were spent in that most interesting country, mainly in the States of Yucatan, Chiapas, and Oaxaca. The writer (Mr. Holmes) was a member of the party, and, as Curator of Anthropology in the Field Columbian Museum, was expected to examine and describe such archæologic remains as happened to be encountered during the journey."

Mr. Holmes made excellent use of his opportunities, and we now have the first instalment of his Report, intituled "Archæological Studies among the Ancient Cities of Mexico," dealing particularly with the monuments of Yucatan.

After an introductory chapter (with excellent illustrations), which treats of the materials and methods used in construction of Maya buildings, Mr. Holmes describes in turn the different groups of ruins which were visited, beginning with those on the islands lying close to the eastern coast of the peninsula, Mugeres, Cancun, and Cozumel. An excellent reproduction of a photograph, taken by Mr. E. H. Thompson, shows the very curious portal of a small temple on the last-named island, with one of the two supporting columns formed of a kneeling human figure.

On first opening Mr. Holmes's report I turned over the pages hastily to find an account of the ruins of Tuloom, but was doomed to disappointment. On page 75 is the following paragraph: "The most important group of ruins on the east coast of Yucatan, so far as the remains have been reported, is that known as Tuloom. It is situated on a high bluff overlooking the sea, some twenty-five miles south-west of San Miguel, the main settlement of the island of Cozumel. It was visited by Stephens in 1840, and he has given us the only available account[1] published up to date. This place must have been an important stronghold of the ancient Mayas, although it was not visited by the early Spaniards, so far as our records show. It is a remarkable circumstance that this place is held to-day by a Maya tribe which has never been permanently subdued by the Spaniards or Mexicans, and which now holds it as an outpost, being at war with the Mexican Government and with all intruders, whatsoever their nationality. At the time of our visit to Cozumel there were special symptoms of hostility, and the sub-chief, to whom the Tuloom district was entrusted by the principal chief, whose headquarters are some distance inland, had recently been summarily executed for permitting trade between his people and the inhabitants of Cozumel. It was natural, therefore, when the leading citizen of Cozumel, Don Pedro Perez, assured us that we would certainly be fired upon by the hostiles if we attempted to land, that the project of studying this ruin was abandoned."

I most fully sympathise with the travellers in their disappointment in failing to examine this important site, which, as far as I know, has never since the time of Stephens and Catherwood been visited by any one capable of giving an adequate description of the ruins.

The yacht then sailed round the north of the peninsula, and the travellers were landed at Progreso, whence a land journey was taken to visit the celebrated ruins of Uxmal, Izamal, and Chichén Itzá.

Uxmal is so easy of access, and has been so often visited, photographed, and described, that Mr. Holmes could not be expected during a short visit to discover anything which would add to our previous knowledge; but the admirably clear description which he gives of the ruins is accompanied by a plan and by a most carefully compiled panoramic view of the site, which will prove of the greatest assistance to the reader.

Plate vii. gives a photograph of an inscribed column or stela discovered by Mr. Thompson, which is of the utmost value, as so very few examples of carved hieroglyphic inscriptions have as yet been found in Yucatan, and a comparison of the Yucatec inscriptions with the numerous inscriptions found in Guatemala and Chiapas

1 Stephens' "Incidents of Travel in Yucatan," vol. i. p. 390.

is a matter of the highest interest to students of American archæology.

I trust that in a future publication Mr. Holmes will give us a drawing of the whole of the inscription on this stela, as only a portion of it is shown in the photograph.

After a glance at Izamal the travellers went on to Chichén Itzá, where they remained for a week. As I was myself encamped for five months at Chichén Itzá in 1889, engaged in clearing and examining the ruins, I am well able to appreciate the great extent and excellence of the work accomplished by Mr. Holmes during the short time at his disposal. The property on which the ruins stand has recently passed into the possession of Mr. E. H. Thompson, formerly United States Consul in Merida, who has for many years been an ardent student of Maya archæology, and amongst other work has made an exhaustive examination of the ruins of Labná for the Peabody Institute at Harvard. Now that Mr. Thompson is resident at Chichén, we may look forward to many interesting discoveries by one who has had such long experience in the field.

I can only express my regret that at the time of his visit Mr. Holmes had not yet received copies of my plans and photographs (the first portion of which has been published in the *Biologia Centrali Americana*, vol iii.), as his corrections and criticisms made on the spot would have been of the utmost value.

Mr. Holmes's work has been so well done, and must be so acceptable to all students of the subject, that I have some fear that it may seem almost ungracious on my part to note what appear to me some few errors which my longer residence in the ruins enable me to detect.

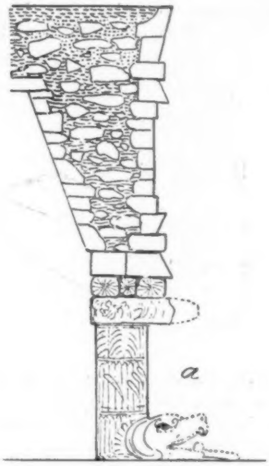
On p. 114, the mutilated figures in the niches on either side of the mask over the doorway of the "Iglesia" are not human figures, but apparently humanised animals, one being a turtle and another an alligator.

On pp. 116–117, the curious round tower known as the "Caracol," is figured and described as symmetrically placed on its double terraces; but I found the upper terrace to be curiously uneven, and unsymmetrically placed on the lower one.

On p. 119, Mr. Holmes states: "The exterior conformation of this strange tower can be made out in part only. The lower wall is of ordinary masonry, finished in plaster, and broken only by the four entrances. It rises nine or ten feet to the base of the formidable, five-membered moulding, which projects two feet from the wall face and is five feet in width, being the only example of its kind in Yucatan. The upper margin is opposite the middle of the arch slope within, as seen in the section. The masonry at this level is four feet thick.

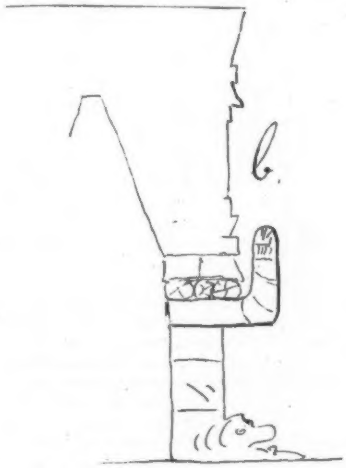
"In studying this part of the building the very interesting question arose as to whether the exterior wall surface above this moulding rose vertically or whether it sloped inwards toward the upper turret. I had the good fortune to find one vertical stone, representing the first course above the moulding, in place, and this I regard as conclusive proof that the upper wall-zone was vertical. This conclusion is confirmed by the fact that in all cases in Yucatan and Chiapas, so far as I have observed, where the upper mural zone slopes, it includes with it in the slope not only all the courses above the medial mouldings, but the medial mouldings themselves, whereas in this case the mouldings are vertical." This conclusion is of considerable importance, and shows that I have fallen into an error in my figuring of the upper part of the Caracol (*Biol. Centr. Am.*, vol. iii. plate 20), and makes me regret all the more that my plans and photographs were not in Mr. Holmes's hands when he was at Chichén.

On p. 124, in describing the "Castillo," Mr. Holmes suggests that the balustrades of all four stairways ended in serpents' heads; but this is the case in the northern stairway only. I moved many tons of earth and stones in order to uncover the base of the western stairway, and found the end of the balustrade to be without any ornament whatever. I cannot agree with Mr. Holmes in the assumption that the corners of the pyramidal foundation were ornamented with great serpents' bodies "following in and out the nine-terraced steps." The structure of the



rounded corners of the pyramid can be fairly well made out at the north-east angle; but in all probability it was thickly overgrown, and so escaped notice.

In describing the portal of the Castillo, and the portal of the temple on the wall of the Ball Court (the temple of the Tigres), Mr. Holmes has just failed to catch the full structure of the serpent columns. These

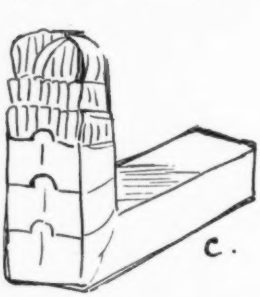


columns are markedly characteristic of Chichén Itzá, and the portals of no less than six of the temples were supported by them. One is figured in the frontispiece (Plate 1), and again in the sections of the Castillo and of the Ball Court temple. The figure here reproduced (*a*) is from the section of the Castillo (p. 123). The more correct drawing would be as in (*b*), the projection from

the capital (*c*) of the column, turning upwards and being carved to represent the rattles on a rattlesnake's tail, with the addition, in some instances, of a plume of feathers.

It is this peculiar form of capital which has done so much to ensure the ruin of the façades of the Chichén Itzá temples; for the weight of the projecting tail tilted the capital outwards as the wooden beam above it decayed.

Some of these queer-shaped capitals (*c*) can be found lying on the slopes or at the bottom of the pyramidal



foundations of the temples; and it is only in the case of the Castillo, where the projecting tail has been broken off, as shown in Fig. *a*, that the façade of the temple has escaped destruction.

On page 132 it is stated that "the lintel beams of the doorway (temple of the Tigres), three in number, and set as indicated in the section, are covered with well-executed glyphs." For "glyphs" must be here read "ornaments," as there is no trace of any hieroglyphic inscription.

I notice that in describing the painted mural decoration of the interior of this temple no notice is taken of the picture above the doorway of a human sacrifice, and I greatly fear it must have disappeared since I traced it in its already mutilated condition in 1889.

Mr. Holmes was not able to attempt any detailed examination of the great group of colonnades and temples which lie to the east and south-east of the Castillo. These I surveyed in 1889, but had no time to make satisfactory excavations, and I greatly envy Mr. E. Thompson the opportunity he has of making a thorough exploration of these most interesting remains.

There is one point on which I hope Mr. Holmes will give us some further enlightenment. On page 102 he states, without quoting his authorities, that Chichén Itzá was occupied by its builders for nearly 200 years after its discovery by the Spaniards.

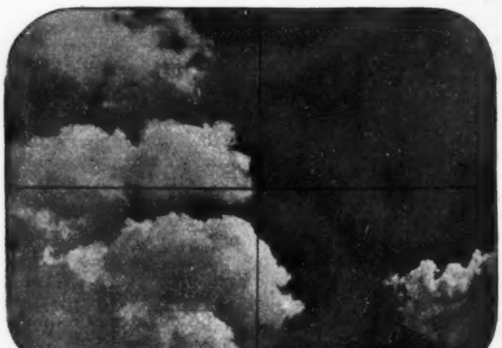
I have endeavoured to show in my own account of the ruins (*Biol. Centr. Am.*, vol. iii. pp. 5–9), that the statement that the Spaniards encamped at Chichén in 1528 must be received with caution, and neither Bishop Landa, nor the report drawn up at Valladolid in 1579, appear to me to indicate any occupation of Chichén by the Mayas at the time of the conquest, although it may still have been held in reverence as a place of pilgrimage.

Part i. of Mr. Holmes's report ends with the description of Chichén Itzá. The descriptions throughout are lucid, and the illustrations numerous and excellent. All students of American archæology will eagerly look forward to the succeeding issues, and will, I feel sure, join me in hearty congratulations to Mr. Holmes on the excellence of his work, and to the Field Columbian Museum on having thus been able to utilise his services; and all of us, who have expensive scientific hobbies, must wish that there were more Alison Armours in the world to give such splendid and timely help to scientific research.

ALFRED P. MAUDSLAY.

MEASUREMENT OF CLOUD HEIGHTS AND VELOCITIES.[1]

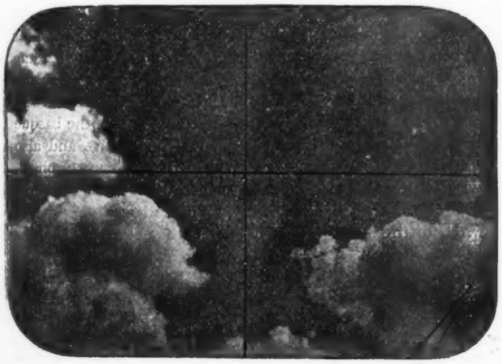
THE study of the form and motion of the clouds has been a favourite subject with meteorologists and physicists from the earliest times. Among the first works, since the invention of printing, may be mentioned one by J. Alkindus (Venice, 1507), dealing with clouds in general, and one on the height of clouds, by J. Bernoulli, "Nova ratio metiendi altitudines nubium" (Lipsiae, 1688). But it is only during the last quarter of a century, since it has been recognised that cyclones and anticyclones form part of the general circulation of the atmosphere, that the importance of a systematic study of the upper air-currents by means of clouds has been fully appreciated. For this purpose various methods, both with and without instruments, have been employed. In 1878 the Meteorological Council decided upon undertaking a series of experiments at the Kew Observatory, with a view of obtaining records of the height and velocity of clouds, by means of photography, for which purpose cameras fitted with theodolite mountings, and provided with altitude and azimuth circles, were used. The results of subsequent investigations, in which the exposure of the plates was effected by electrical means, were published in the *Proceedings* of the Royal Society, vol. xlix. p. 467. In vol. viii. p. 108, of the *American Meteorological Journal*, Mr. Rotch gives an account of the measurements of cloud velocities at Blue Hill Observatory, Massachusetts, by timing the movement of shadows cast by the clouds at points whose distance apart was known. During the present year, owing to the action taken by the International Meteorological Committee, cloud observations are being made in all parts of the globe, and instructions for the use of special instruments have been drawn up, at the request of the Committee, by Dr Hildebrandsson, of Upsala. The majority of stations, if they use instruments at all, restrict themselves to the use of simple nephoscopes, which give the direction and apparent velocity of the clouds, by means of a mirror and graduated circles; in these instruments the observations are not influenced by the effects of perspective, which are the same in the sky and in the mirror. At



some of the principal observatories theodolites and photogrammeters are being used. Each of the last two methods has its advantages and disadvantages; theodolites are simpler and cheaper, while photogrammeters require a certain amount of skill in photography. The

[1] "Wolkenhöhenmessungen," von E. Kayser (*Schriften der Naturforschenden Gesellschaft in Danzig*, 1895); "Des principales méthodes employées pour observer et mesurer les nuages," par H. H. Hildebrandsson et K[l] L. Hagström (Upsala, 1893).

theodolite requires the two observers—each placed at one end of the measured base—to agree by telephonic correspondence on one fixed point in the cloud, which it is not always easy to do, as well as on the precise instant at which the observation should be taken; the calculation of the observations is subsequently made from trigonometrical formulæ, or by a slide-rule, or plotting machine. The photogrammeter, which is a theodolite provided with a small telescope and a camera obscura, possesses one great advantage from the fact that the two observers have no need to agree as to the special point to be observed; it is sufficient that both photograph the same part of the sky at the same moment. On each photographic plate the coordinates of a point of intersection are known, and by placing it upon a glass scale graduated to millimetres the coordinates of as many points as may be desired can be fixed; it is only necessary to determine, once for all, how many minutes correspond to a millimetre on the plate. Once the coordinates are found, the calculations can be made as in the case of the theodolites. As these researches require the calculation of a great number of observations, it is indispensable that the methods employed in reducing them should be as simple as possible. This desideratum has been solved by M. Åkerblom, in a very satisfactory manner, in a pamphlet entitled "De l'emploi des Photogrammeters"



(Upsala, 1894), which has been distributed by Dr. Hildebrandsson to intending observers. Easy methods of reduction, giving approximately correct results, have also been devised by General R. Strachey and Sir G. Stokes.

We have before us a valuable investigation by Dr. Kayser, containing some 1500 cloud measurements made under the auspices of the Philosophical Society of Danzig, between May and August 1895, by means of photogrammeters. In various respects the camera used appears to be an improvement on some of the instruments hitherto adopted, being of simple construction, well balanced, and combining ease of movement with necessary rigidity, while the altitude and azimuth circles are sufficiently large to admit of accurate reading. The accompanying plates are reproductions of a pair of photographs of a cumulus cloud observed by this means on May 25, 1895. The mean height of the cloud from several measurements was found to be 1714 metres, the distance between the two observing stations being about 679 metres. In order not to delay the publication of the Society's volume, no classification of the heights of the various clouds has been made; but in the *Meteorologische Zeitschrift* for May, Dr. Sprung has attempted this, and finds the mean values in metres to be as follows:—Stratus, 1704; cumulus, 2856; strato-cumulus, 2196; alto-cumulus, 4098; cirro-cumulus, 6834; cirrus, 10,043. The daily variation of altitude cannot be deduced from these observations, because they were not distributed sufficiently uniformly throughout the day. Dr. Kayser's work contains useful materials for the study of observers during the international cloud year, and we are glad to see that the observations are to be continued this summer.

NOTES.

ON Wednesday in last week, the Queen invested Lord Kelvin with the Riband and Badge of a Knight Grand Cross of the new Royal Victorian Order.

SIR WILLIAM MACCORMAC has been elected President of the Royal College of Surgeons of England.

GENERAL M. RYKATCHEF has been appointed Director of the Central Physical Observatory, St. Petersburg, in the place of Dr. H. Wild, resigned. For many years General Rykatchef has had charge of the maritime meteorological branch of that Observatory.

IN the House of Commons on Friday last, Sir S. Northcote asked the President of the Board of Trade if he would introduce this Session a Bill to deal with the metric system, in order that chambers of commerce and other parties interested might have sufficient time during the recess to consider the proposals of Her Majesty's Government on this subject. Mr. Ritchie replied that he would be glad to introduce the Bill, but without any intention of proceeding with it this Session.

THE large male Indian elephant which was brought home by the Prince of Wales from India in May 1876, and which died in the Zoological Society's Gardens on March 8 last, has been successfully mounted by Mr. E. Gerrard, jun. The specimen is at present placed in the Central Hall of the Natural History Museum, just opposite the principal entrance; but it will be ultimately moved to the Mammal Gallery, which is now in process of rearrangement, when space has been found for it.

A FINE example of the Pangolin, or Scaly Anteater, is now on view at the Zoological Society's Gardens, having been placed there, on deposit, by the Hon. Walter Rothschild. Pangolins are seldom seen in captivity, being very difficult to keep in good health. There has been no example of this form in the Society's collection for nearly twenty years. The present specimen, which seems likely to do well, belongs to the species called the Short-tailed Pangolin (*Manis temmincki*), of which a good figure is given in the third volume of "The Royal Natural History," lately published. It is said to have been obtained in the Transvaal.

DR. KLEIN recently delivered three lectures on the subject of "Recent Researches in the Identification of the Typhoid Bacillus and the Cholera Vibrio," being the Harben Lectures in connection with the British Institute of Public Health. The lectures are the property of that Institute, and will be published in its official organ, *The Journal of State Medicine*. The first lecture has just been published in the July number. The other lectures will appear in the August number.

BY means of a rearrangement of existing scholarships at the Charing Cross Hospital Medical School, and by the establishment of a special fund, memorials have been founded to Dr. Livingstone and Prof. Huxley, both old students of the school. The memorial to Livingstone takes the form of an entrance scholarship of 100 guineas per annum, and that to Huxley of (1) an entrance scholarship of £55, open to the sons of medical men; (2) a second year's prize in anatomy and physiology; and (3) a lectureship dealing with recent advances

in science and their bearing on medicine and surgery. The first of these Huxley lectures will be delivered in the anatomical theatre of the Medical School on Monday, October 5, by Dr. Michael Foster.

THE Bertillon system of anthropological measurements has just been adopted at the Sing Sing States Prison.

THE 126th meeting of the Yorkshire Naturalists' Union will be held at Staithes, for the investigation of the neighbouring coast, and the Easington and Roxby Woods, on Bank Holiday Monday, August 3, 1896.

THE annual meeting of the Society of Chemical Industry was held as we went to press last week. In the course of his presidential address, Mr. Thomas Tyrer compared the German and English chemical industries, and remarked: "The real cause of the progress and prosperity of the former is to be found in the superior qualifications of the directing minds. Germany does not owe her progress alone to protective tariffs, nor to the superior discipline of her workmen, but to her thorough system of education, elementary and secondary. Dr. Seth Low's definition of a college as a place for liberal culture and a university as a place for specialisation based on liberal culture, is true of Germany, and should be so for Britain. The agitation for a teaching university for London is, therefore, a good thing. Moreover, no scheme of education will approach perfection unless it provides for the graduated affiliation of schools and colleges with universities. The City Companies and Guilds of London are taking a prominent part in supplying the great need for scientific training; and with all the resources of this wealthy country, the practicality of its people, and the public spirit of its citizens, we ought to remain very little longer in a state of educational backwardness. It is but necessary that the State shall define the need, and the steps by which that need shall be met, and then resolutely carry them out." The Council recently instituted medals to be awarded at intervals of not less than two years for conspicuous services rendered to applied chemistry by research, discovery, invention, or improvement in processes. The first award was made, at last week's meeting, to Mr. John Glover, inventor of the "Glover" tower, the introduction of which marks an important development in alkali manufacture. The newly-elected President of the Society is Dr. Edward Schunck, F.R.S.

THE naturalists of the Marine Biological Association have recently been paying particular attention to the question of the collection of fishery statistics, and an important report on the subject has just been received by the Council of the Association. In this report an account is first given of the statistics at present collected and published by the Board of Trade relating to sea-fisheries in England. It is pointed out that the methods at present adopted for collecting the statistics are not such as to give confidence in the accuracy of the returns, whilst their inadequacy in plan and extent cannot be questioned. The defects upon which emphasis is principally laid are the want of sufficient discrimination between the species of fish landed, the lack of all information as to the locality of capture of the fish, and the fact that no attempt is made to distinguish between the products of different methods of fishing. Various suggestions are made as to the methods by which the statistics could be improved, and it is maintained that the only really satisfactory course would be to require the master of each fishing vessel to supply the Board of Trade with correct returns of the fish caught, and of the locality of their capture. In the case of the larger vessels, at any rate, such records already exist, and are supplied by the master to his owners. All that is required is that copies of these records should be furnished to the proper officers, so that the information may be utilised for the general benefit of the public and of the fishing industry. The report will be published, in full, in the forthcoming number of the *Journal* of the Association.

As previously announced, the autumn meeting of the Iron and Steel Institute will be held at Bilbao on September 1-4. The Local Reception Committee, which comprises all the various local authorities, corporations, ironmasters and miners, with Don Julio de Lazurtegui as honorary secretary, has now drawn up an outline programme of the meeting. The Orient Company's s.s. *Ormuz*, which has been detailed to convey the members to Spain, and to serve as a "floating hotel," will leave Tilbury for Portugalete at noon on Saturday, August 29. On the arrival of the *Ormuz* at Portugalete, the Reception Committee will go out to meet the steamer, and will welcome the visitors. Immediately after this visit the members will visit the new harbour and breakwater now in course of construction, and continue up the river Nervion to Bilbao, inspecting on their way the electric installation of MM. Coiseau Couvreux et Félix Allard, for making the mammoth concrete blocks used in the construction of the breakwater. On Tuesday, September 1, the members will formally visit Bilbao, where they will be welcomed by the Alcalde in the *Salon de Actos* of the Provincial College. The general meeting for the reading and discussion of papers will then be held. In the afternoon the members will visit the steel works of the Sociedad de Altos Hornos; and in the evening, there will be a reception by the Alcalde in the new Municipal Buildings. On Wednesday, September 2, after the general meeting and luncheon, the members will visit the steel works and coke ovens of the Sociedad La Vizcaya, and afterwards the tin-plate works of the Sociedad La Yberia. In the evening, there will be a grand tennis match (the basque ball game of *Pelota*) in the Euskalduna Tennis Court, and also a *fête champêtre* and concert, at which the Bilbao Orpheon of 100 members have consented to sing, in the Campos Eliseos. There will be no general meeting on Thursday, September 3, the whole of the morning being devoted to visiting the mines. The *Ormuz* will leave Portugalete on the following day for Santander, where the mines will be visited. Short stays will be made at San Sebastian and St. Jean de Lux on the way back to London, which will be reached on Saturday, September 12.

THE sixty-fourth annual meeting of the British Medical Association will be held at Carlisle, on July 28-31. The President-elect is Dr. Henry Barnes. An address in medicine will be delivered by Sir Dyce Duckworth, and one in surgery by Dr. R. Maclaren. The scientific business of the meeting will be conducted in nine Sections. The President of Section A (Medicine) is Dr. George F. Duffey; and among the subjects down for discussion are: the treatment of cardiac failure, with special reference to the methods of passive exercise, active exercise and baths; anæmia, its varieties, causation, associated pathology, and treatment; tuberculosis, its prevention and cure. In Section B (Surgery), presided over by Dr. A. Ogston, Dr. Macintyre will demonstrate the use of Röntgen rays in surgery, with special reference to the cavities of the body, instantaneous photographs, and fluorescent screens. Section C is devoted to obstetrics and gynæcology; the President is Dr. J. H. Croom. Sir Joseph Ewart, President of Section D (Public Medicine), will open the Section with an address. Among the subjects to be brought forward are: Medical research in relation to hygiene, vaccination and revaccination with animal vaccine in Germany, and diphtheria in town and country. Section E (Psychology) will be opened by the President, Dr. J. A. Campbell, with an address. Most of the papers down for reading and discussion in this Section belong to pathological psychology. An introductory address will be delivered to Section F (Pathology and Bacteriology) by the President, Dr.

Sheridan Delépine; and there will be a discussion on the relation of the morbid conditions dependent on (or associated with) the presence of streptococci. Dr. David Little will preside over Section G (Ophthalmology), Dr. J. Finlayson over Section H (Diseases of Children), and Dr. T. F. I'Anson over Section I (Medical Ethics). A number of garden parties and other social functions have been arranged, and these will help to lighten the large amount of work which the various Sections will have to do.

IT was shown by M. H. Moissan, about three years ago, that when iron was saturated at 3000° C. with carbon, and then cooled under a high pressure, a portion of the carbon separated out in the form of diamond. It occurred to M. Rossel (*Comptes rendus*, July 13), that the conditions under which very hard steels are now made, should also result in the formation of diamonds; and an examination of a large number of samples of such steel has shown that this is really the case. The diamonds are obtained by dissolving the metal in acid, and then subjecting the residue to the action of concentrated nitric acid, fused potassium chlorate, hydrofluoric and sulphuric acids successively. The crystals are very minute (about 15 $\mu\mu$), the largest attaining only 0·5 mm. in diameter, but they present all the chemical and physical properties of true diamonds.

THE detection and estimation of small amounts of marsh gas in air is a problem of considerable practical importance in the ventilation of mines, and numerous instruments having this object have been designed. In the May number of the *Bulletin de la Société d'Encouragement pour l'Industrie Nationale*, Mr. E. Hardy describes a new apparatus for this purpose which presents many novel features. The principle utilised is the variation of the velocity of sound in a gas with its density. The air under examination is forced through a small organ pipe, and the note thus produced compared with that given out by a second pipe fed under parallel conditions with pure air, the number of beats per second produced giving a measure of the methane present, the apparatus being so arranged that the moisture, carbonic acid, and possible variations of temperature exert no influence on the result. Three types of instrument are constructed, portable, fixed, and self-recording. In the second type a telephone from any convenient place is put in connection with two microphones placed on the organ pipes, so that by simply counting the number of beats, the manager can instantly recognise from his office the presence of fire-damp in the part of the mine from which the air is being drawn, 1 per cent. of methane giving about three beats per second. The only drawback to this ingenious apparatus is that it is rather complicated in detail, and therefore costly, especially in the self-recording type; but the advantages of extreme simplicity in actual use, combined with the convenience attaching to the telephone, will doubtless outweigh this in practice.

IN a paper on gall-making coccids, contributed by Mr. C. Fuller to the *Agricultural Gazette* of New South Wales (vii. 4), some details are given concerning the genus Brachyscelis, the members of which live exclusively upon species of Eucalyptus, causing the growth of woody galls, in the heart of which they dwell. These coccids are popularly known in Australia as "gall-makers," but the gall-growth differs from the "meal" of the mealy-bug and the "scale" of the bark-louse—which are other Australian species of Coccidæ—in that it is brought into existence at the actual and direct expense of the tissue of the plants, whilst the meal and the scales are products secreted or excreted from the bodies of the insects themselves. The larvæ of all Brachysceles are so similar in appearance as to afford no sufficient characteristics for the determination of species. The male galls take the form of short cylindrical tubes, not exceeding six lines in length, and generally growing upon the leaves. The female galls exhibit a great variety of forms, which supply the easiest means of distinguishing the different species, and which vary in length from half an inch to six or seven inches. Some resemble cones, others nuts and fruits, whilst the latera growths, due to *B. duplex*, are not unlike leaves. Occasionally supported on stalks, they are more often sessile upon the branches, twigs, or leaves from which they spring. These abnormal members of an aberrant group like the Coccidæ should repay further study.

Do varieties of peas run out? This problem is dealt with in *Bulletin* No. 131 of the Michigan Agricultural Experiment Station, and the answer is that varieties at least lose their original characteristics. Such "runningout," however, does not necessarily imply deterioration, as sometimes it is merely a changing of characters. Accurate descriptions accompanied by drawings are kept of varieties of peas grown at the station. These serve to show that varieties change from year to year—even the old standard sorts, the characters of which are supposed to be firmly fixed. The foliage and habit of the plants are found to be less variable than the peas themselves, which are generally the object of selection. The variety Stratagem was grown from seed obtained from three different dealers. In all, the characteristic dark green foliage, stalky, angular veins, and exceedingly short nodes of the variety named were apparent. But the pods, though irregular and varying in each sample, yet, taken as a whole, were distinctly different. In two of the samples the pods were fairly uniform, but in the third they were so irregular—probably reversions to one of the parents—that the peas were almost worthless. It is a matter of common observation that seed peas of the same variety, especially the wrinkled sorts, differ in colour as supplied by different seedsmen. In several cases peas grown on the station grounds have changed the colour of their seed within the last four years.

A BRIEF statement of the facts as to the anti-cholera serum experiments carried out by Prof. Kitasato, of Tōkyō, is made by Dr. A. Nakagawa in the current number of the *British Medical Journal*. Preliminary experiments in the laboratory for ascertaining the curative action of the serum were carried on in this wise: A number of guinea-pigs were inoculated with several times the fatal dose of the virus, so that the untreated animals died within twenty hours after such inoculation. At the expiration of each successive hour injections were made in some of the animals, and it was shown that those treated not later than seven hours after the inoculation of the virus were cured, while those in which the injections were made after the lapse of seven hours could not be saved by the serum. In other words, if injected during the first third of the entire course of the disease (thus experimentally produced) the serum can be considered curative. Cases of cholera were afterwards treated with anti-cholera serum at the Hiroo Hospital, Tōkyō. Of 270 cases admitted, 138 died, which gives a rate of mortality of 51·1 per cent. Anti-cholera serum was employed in 193 cases only, owing to the fact that the supply of serum was inadequate to allow it to be used in all cases. The rate of mortality among Japanese in nearly all the previous epidemics, as well as that of the last epidemic, has always been about 70 per cent. Without claiming to draw, from a number relatively so small, the final conclusion that the serum treatment was attended with the reduction of 20 per cent. in the mortality statistics, it is evident at least that the result of the new therapy was not an unfavourable one. Moreover, Dr. Nakagawa thinks there is reason to believe that, with a sufficient supply of very efficient serum, the rate of mortality can still be lowered.

STUDENTS of Japanese culture will be interested in a paper on "Anatomy and Æsthetics among the Japanese," in *Globus*

(Band lxx. p. 21), by Max Buchner, and in the folk-lore contained in P. Ehmann's paper on "Popular Notions in Japan," in the current volume of *Œsterreich. Monatsschr. für den Orient*, p. 58.

DR. F. SOSSET has published in the *Revue de l'Université de Bruxelles* (vol. i. p. 481) a painstaking account of weaving in Ancient Greece, and has employed various representations from Greek vases and other sources to illustrate the accounts given by the classical writers. Those who are interested in the development of the industrial arts should consult his memoir.

THE contemporaneity of Man with the Gigantic Fossil Sloth Megalonyx appears to be now established, Mr. H. C. Mercer having recently obtained distinct evidence on this point in the Big Bone Cave, Van Buren County, Tennessee. The full report, which will be published by the Archæological Department of the University of Pennsylvania, will be awaited with interest, as it should provide data towards the solution of the problem of the length of time man has existed in the New World.

THE British Museum possesses several very beautiful and valuable examples of Ancient Mexican mosaic work. These, together with examples in other European museums, have been figured and described by Mr. A. Oppel in *Globus* (Band lxx. p. 4). The most important material of these mosaics is turquoise; in none is it wanting, and on one shield in Vienna it is the only stone employed, tesseræ of shell (white, light red, and purple-red), nacre, malachite, gold, obsidian, and other materials are also employed. The masks, head-dresses, shields, and other objects which were decorated in this sumptuous manner, were evidently employed in the ancient religious ceremonies.

UNDER the title of "Common Sense in Chess," an abstract of twelve lectures delivered by Mr. Lasker in London last year, has been published by Messrs. Bellairs and Co. As an exposition of the methods of this brilliant player, this pamphlet will be read with much interest, more especially since, instead of the exhaustive variations of the openings customary in works of this class, an attempt is made to base the conduct of the game upon a few simple general principles. These principles are advanced in the opening chapter as empirical rules, to which the games worked out in the subsequent chapters supply the proof.

WE are glad to be able to report a considerable step in advance made by the Observatory at Athens by the publication, from the 4th ult., of a daily weather report containing twenty-five stations in Greece, and about double that number of exterior stations. The report is accompanied by two charts, one showing the isobars and general meteorological conditions at 8 a.m. over a large part of Europe, and one showing wind and temperature over Greece and adjacent islands. Observations have been made regularly at the Athens Observatory since 1858, some of which have been published and discussed; but we are not aware that the issue of synchronous charts, in the form adopted by other countries, has been before attempted.

THE additions to the Zoological Society's Gardens during the past week include a Squirrel Monkey (*Chrysothrix sciurea*) from Guiana, presented by Mrs. Turner-Turner; a Huanaco (*Lama huanacos*, ♂) from Bolivia, presented by Mr. J. F. Schwann; a Passerine Owl (*Glaucidium passerinum*), European, presented by Miss Bloxam; four Rough-keeled Snakes (*Dasypeltis scabra*), a Lineated Boodon (*Boodon lineatus*), a Rhomb-marked Snake (*Psammophylax rhombeatus*), a Delaland's Lizard (*Nucras delalandii*) from South Africa, presented by Mr. Frederick A. Story; an Agile Wallaby (*Halmaturus agilis*, ♀) from Australia, an Indian Python (*Python molurus*) from India, seven Peruvian Snakes (*Tachymenis peruviana*), nine —— Lizards (*Liolæmus* sp. inc.), five Gay's Frogs (*Calyplocephalus gayi*), six Bibron's Frogs (*Paludicola bibroni*) from Chili, deposited; a Brazza's Monkey (*Cercopithecus brazzæ*, ♀) from French Congoland, a Tayra (*Galictis barbara*) from South America, a Patagonian Conure (*Conurus patagonus*) from La Plata, purchased.

IN our report of the celebration of the Kelvin jubilee, on p. 177 of our issue of June 25, Prof. Cleveland Abbe was inadvertently credited with being the "head of the Meteorological Office, Washington." To prevent misapprehension, it may be desirable to state that the responsible position of Chief of the U.S. Weather Bureau is actually filled by Prof. Willis L. Moore.

OUR ASTRONOMICAL COLUMN.

DOUBLE STAR ORBITS.—In the *Astronomical Journal*, No. 378, Dr. See gives the complete list of the various double star orbits that he has computed and published in various journals. This is a useful compilation, and testifies to a considerable amount of industry, and exhibits his great interest in the subject. The "probable uncertainty" which he has attached to some of the elements is, however, very different from "the probable error," which is an arithmetical result, and has a definite meaning. The "limits of uncertainty" attached to the period and excentricity, give Dr. See's estimate of the degree of success with which he has handled incorrect and inadequate measures. Almost simultaneously with the appearance of Dr. See's paper comes, in *Ast. Nach.*, No. 3364, Dr. Doberck's results of his investigation of the orbit of γ Virginis, and it is scarcely necessary to remark, that he has had under review precisely the same observations that Dr. See has used. If Dr. Doberck is able to add one or two more recent observations, they have been made at a time when the companion is near aphelion, and have little influence on the orbit. Nevertheless, the period and excentricity differ more from the values that Dr. See has obtained than his assigned values of uncertainty. If, then, the treatment of the same observations, by experts in this class of computation, lead to sensibly different orbits, it is to be feared that new material, arising from the continued observation of stars that have been much less frequently measured than γ Virginis, will lead to still wider discrepancies.

ROTATION PERIOD OF JUPITER.—The movements of the various spots, &c., on the surface of Jupiter have been employed since the time of Schrœter (1787) for observing the period of rotation of the planet. During the last opposition two very marked spots have been specially persistent, and by means of one of them, the "Garnet" spot, Prof. A. A. Rambaut has made a new determination of the period (*Scien. Proc. Roy. Dublin Soc.*, vol. viii. p. 389). All the values hitherto found have demonstrated that the various parts of the surface rotate at different speeds, so this new value simply refers to the zone in which the spot is situated. This is the one having a zenographical latitude of $+13°$, the previously accepted period of which was 9h. 55m. 33·9s. The time was measured by taking the intervals between the transits of the spot over the fixed wire of the micrometer on the "South" equatorial. The time of central transit was taken as the mean of the preceding contact, bisection, and following contact of the spot. Corrections were applied for three sources of error which affect the result, viz.: (1) *Parallax*, (2) *velocity of light*, (3) *phase*. The final value of the rotation of this spot is 9h. 55m. 33·36 $\pm$ 0·53s., which agrees within one-fifth of a second with Schrœter's value.

TELLURIC LINES.—Prof. Ricco has been investigating the relative behaviour of the chief atmospheric lines of the solar spectrum under various observing conditions (*Mem. del Soc. Spettroscopisti Italiani*, vol. xxv. pp. 127–134, 1896). The lines particularly under discussion were 6868 (β), 6517, 6278 (α), 5943 (rainband), and 5800 (δ). Observing the spectrum with a direct vision spectroscope, the relative intensities of these lines were measured in three districts, Etna, Nicolosi, and Catania, with the sun at varying altitudes at each station. From the measured altitudes, the thickness of the absorbing stratum of air traversed was calculated for each observation. The tension of the aqueous vapour in the air was also recorded at the time each line was measured. On plotting the results graphically, and summing up the measures at each station, the general con-

clusion is that the intensities of all the lines were nearly proportional to the mass of air traversed. The lines 6868 (β), 6517, 6278 (α), and 5800 (δ) were practically of the same intensity, for equal masses of air, at all the three observing stations, showing that the presence of water-vapour had little or no influence on them, and indicating that their origin was most probably atmospheric oxygen. The *rain-band* line (5943), however, has, for equal masses of air, a much less (about one-third) intensity at Etna than at the other two stations. The mean vapour tensions at the three places, Etna, Nicolosi, and Catania, were as 3 : 7 : 10, so that this line 5943 is evidently due to aqueous vapour. The fact that when the observations are plotted the curves pass through or near the origin, indicates that the atmospheric oxygen and water-vapour are the sole causes of these telluric lines.

EXPLANATION OF SOLAR PHENOMENA.—In the June number of the *Astro Physical Journal*, J. Fényi discusses several new explanations of the various features of the solar surface, emphasising several physical facts, hitherto neglected, the consideration of which simplify the conception of the causes of the solar phenomena. He assumes that the prominences are masses of real matter in violent motion, and also that they are ejected into *free space*. The crucial point of his argument is that when a mass of hydrogen, say, is projected from the photosphere, and has passed through the chromosphere into free space, it is not diffused immediately, but takes a certain time, termed the *expansion interval*, which varies *directly* as the diameter of the mass, and is *inversely* proportional to the square root of the absolute temperature. By following out in detail the phenomena of eruptive prominences, he explains them all on this view, especially their unusual brightness and rapid dissolution. The *white* prominences he accounts for as being the expanded gaseous portions of former ordinary prominences, rendered visible by reflected sunlight. The *corona* he regards as being due to more distant masses of these gaseous materials, primarily ejected as prominences, the enormous length of some coronal streamers being no difficulty if they are admitted to be projected in free space. *Faculæ* will then be produced by these gaseous matters falling down on the photosphere again, their superior brightness being due to the heat generated during their fall, together with the actual radiation received from the sun itself. Their prevalence in sun-spot zones is explained if they are the consequence of eruptive prominences, which themselves favour these zones. This dispenses with the view that faculæ are projected prominences, and regards them as the *result* of prominence action. The much-disputed question of the reason of distorted spectral lines in prominences is greatly simplified by this explanation. If a mass of ascending gas as a prominence encounters a descending mass from a previous eruption, the resultant motion will in general be tangential to the solar surface, and will be capable of producing the enormous velocities in the line of sight which have been measured in prominence spectra, and which could not be explained as being the result of mere explosions from the photosphere.

NEW FORM OF APPARATUS FOR THE PRODUCTION OF RÖNTGEN RAYS.

SOME time in the month of March this year, after working with various forms of tubes, it occurred to the writer to abolish the glass vessel by converting the ordinary concave kathode into a nearly complete sphere, with the platinum anode at its centre. A simple experiment with a Jackson bulb proved that the rays from the anode could pass through the material of the kathode as they would through a similar piece of unelectrified aluminium placed outside the bulb. Hence it became fairly evident at the outset that the proposed plan would work to some extent.

Under the guidance of Prof. Lodge, and in his research laboratory, experiments were commenced. The first arrangement was a simple one. The sphere was made in two halves, one half of copper and the other of aluminium. The two halves were joined together with marine glue only. The anode was held in position by ebonite fixed in the copper hemisphere. A section of this simple arrangement is shown in Fig. 1. The section is drawn to scale, the diameter of the sphere being 2 inches. This early apparatus showed signs of success, and it was decided to invest in a larger sphere—one of 3½ inches in diameter. The joints were now made much more carefully, and the apparatus so designed that it could be fitted together or taken to pieces in half an hour's time. The hemispheres of copper and aluminium were soldered together, but the joints (A and B, Fig. 1) were made by compressing indiarubber washers by means of suitably made screws. With this convenient apparatus the behaviour of various sizes and shapes of anodes was observed. In all the experiments a small thick plate of platinum, having a plane surface of about ¼ square inch, was reserved for that portion of the anode which received the kathode rays; the remainder of the anode was sometimes of aluminium and sometimes of copper. The various forms tried are shown in Figs. 2 to 8.

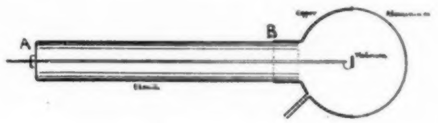


Fig 1

In Fig. 2 we have the simplest possible anode—the platinum plate alone. It is the same arrangement as that of Fig. 1, the only difference being that of dimensions. This form possessed an enormous resistance, so that only with low vacua could a current be made to pass through. For this reason the behaviour of this form was unsteady and its periods of activity very short. With higher vacua and greater potentials, no doubt this form would be more successful. Another form tried was that shown in Fig. 3. The anode here was very considerably enlarged by placing a circular plate of metal just behind the platinum, at a place where no kathode rays could fall on it. By this means the area of the anode surface was increased sixteen-fold approximately. The resistance was thereby much reduced, and it became possible to work at higher vacua. This form gave a more powerful and a considerably more uniform radiation than that of its predecessor.

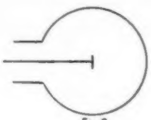


Fig 2

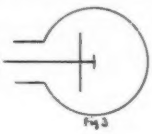


Fig 3

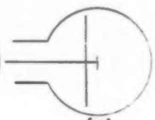


Fig 4

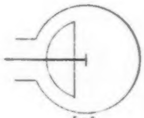


Fig 5

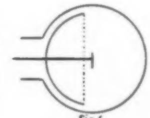


Fig 6

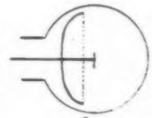


Fig 7

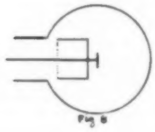


Fig 8

The next step was to increase still further the area of the anode (see Fig. 4). The anode now nearly filled the sphere. The result, however, was not so good, tending to show that the best size of anode is something less than Fig. 4, and greater than Fig. 2; but Prof. Lodge thinks that this is a question of the particular vacuum employed. Another differently-shaped anode was next tried. This was formed of a metallic hemisphere with a flat plate in front of it (see Fig. 5). The idea was to get all, or nearly all, of the electric discharge, and so possibly most of the kathode radiation also, to take place between the outer aluminium hemisphere and the anode. The idea probably is a crooked one; anyhow, this form proved less successful than others. The plate was next removed, and the hemisphere was replaced by a larger one, as in Fig. 6. For some unknown reason this form gave no radiation whatever, although the

vacuum was fairly high. The resistance, however, was low. The experiment was not really a successful one, for there arose some trouble from either small leakages or vapour pressures. The next form was Fig. 7. This gave really bright flashes on a sensitive screen, and the resistance was low. Still another form is that of Fig. 8. The anode now is a hollow cylinder with one end open. The total area of this anode is considerably greater than that of Fig. 3, but the latter gave much the more powerful radiation. It appears, therefore, that both the size and the shape of the anode have an important influence on the radiating power of the apparatus.

The form which gave the most powerful radiation was that of Fig. 3. This sent a powerful radiation through 3 feet of solid timber. The rays on emerging were received on a fluorescent screen made of about fifteen shillings' worth of potassium-platino-cyanide, and the area of which was 36 square inches. This screen was considerably affected by the rays after having traversed the 3 feet of timber, and gave sufficient light to see very small objects in. But the hand, when placed between the screen and the timber, cast no shadow whatever.

The next observation on the power of the radiation was to take the screen to a distance of 30 feet from the source. At this distance the bones of the hand could be seen, but not the flesh. Even the bones cast no deep and sharp shadows at this distance, not owing to lack of fluorescence—for the screen was really bright—but owing probably to the turbidity of the intervening 30 feet of air.

The source was afterwards placed in position at one end of the laboratory, and the screen taken to the opposite end, or rather to the end of the corridor leading to the laboratory—a distance of 62 feet from the source. Even here the screen fluoresced with some energy, but the hand was observed to cast no perceptible shadow. When this apparatus was working, there was no place within the large room where the screen did not fluoresce, the rays passing through masses of timber and tables with surprising penetration.

This experimental tube, however, with its rubber joints and ebonite insulation, is not a lasting concern. Although a good vacuum can be maintained for hours together when not in work, it will not last more than half an hour or so when in continuous use, after which more pumping is necessary. The current evidently produces some change in the rubber and ebonite, disengaging a gas which slowly destroys the vacuum.

In the final instrument the joints are of mercury, and the insulation of porcelain. The joints are first ground and polished, and then flooded with mercury. Except the porcelain, the entire apparatus can be made in the lathe, which is a great consideration. A longitudinal section of the instrument is given in Fig. 9. At the end of the porcelain is an arrangement for focusing, which can be manipulated while the instrument is working, so that a point source can be obtained definitely and easily by trial. This figure, which is reproduced from an early picture, has a spherical anode. This should be replaced by a circular plate resembling the anode of Fig. 3.

This last form of instrument, though designed in the middle of May, has not yet been built, owing to the delay in manufacturing the various parts. The parts are easily enough made, but manufacturers seldom care to attend to single articles except at their own convenience.

In conclusion it may be stated, though it is unnecessary to do so, that the instrument just described owes its existence to the teaching of Prof. Lodge. BENJAMIN DAVIES.

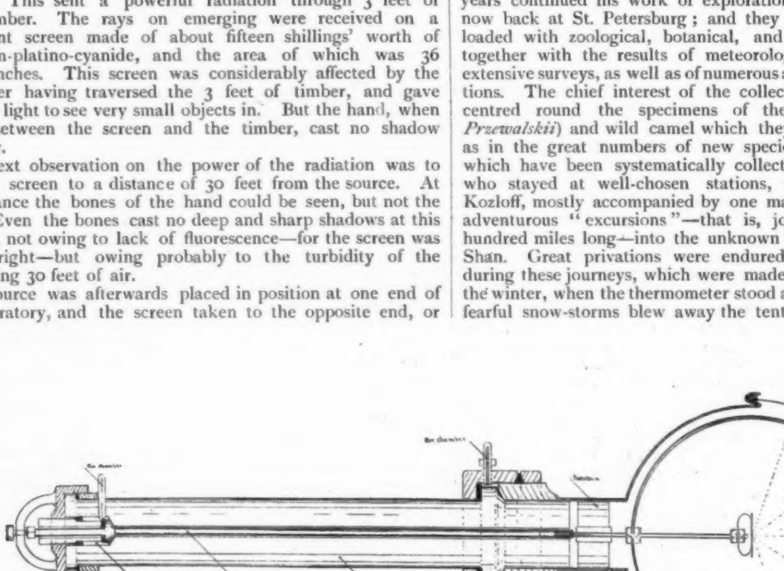


Fig 9

THE ROBOROVSKY EXPEDITION.

ROBOROVSKY and Kozloff, the two explorers who accompanied Prjevalsky in his last journeys, and for two years continued his work of exploration of Central Asia, are now back at St. Petersburg; and they have returned literally loaded with zoological, botanical, and geological collections, together with the results of meteorological observations and extensive surveys, as well as of numerous astronomical determinations. The chief interest of the collections will certainly be centred round the specimens of the wild horse (*Equus Przewalskii*) and wild camel which they have secured, as well as in the great numbers of new species of plants and insects which have been systematically collected by M. Kurilovitch, who stayed at well-chosen stations, while Roborovsky and Kozloff, mostly accompanied by one man only, made the most adventurous "excursions"—that is, journeys three and four hundred miles long—into the unknown highlands of the Nan-Shan. Great privations were endured by the two explorers during these journeys, which were made without guides, during the winter, when the thermometer stood at $-25°$ to $-35°$ C., and fearful snow-storms blew away the tent, while the sand borne by the wind sharply stung the travellers' frozen faces. These privations, of which the Russian travellers speak so lightheartedly, seem, however, to have ruined the health of the chief of the expedition, Roborovsky. And when the expedition made its last journey into the highlands which separate the Nan-Shan highlands from the valley of the Yellow River, Roborovsky, who had already endured pleurisy and erysipelas, was laid down with a stroke of paralysis, which deprived him of the use of all the right part of his body; while the Tangut robbers, who people these mountains, gathered in bands round the small encampment. The expedition was already at the western foot of the high snow-clad chain of peaks of the Alma-machin, which rise on the left bank of the famous bending of the Yellow River; a few days' journey only separated them from the yellow waters of the Hoang-ho; but in such conditions they were compelled to return—the Tanguts immediately taking advantage of the retreat to attack the caravan. They were only repulsed, Roborovsky writes, after "a great loss in men and horses."

Notwithstanding this failure, even the purely geographical results of the expedition, to say nothing of its scientific collections, are very important. From Lake Issyk-Kul the small party proceeded eastwards, exploring the highlands and the plateau of Yulduz, to Karashar, near Lake Denghiz, or Bagrach-Kul, and thence to Turfan and the oasis of Hami. Having now to cross the great desert of the Hashun Gobi, before reaching the Nan-Shans, Roborovsky and Kozloff took

two different routes: the eastern route, Hami to Sa-chou, and the western route, from Kurla to Lob-nor, and thence eastwards to Sa-chou, along the northern foot of the great border ridge, the Altyn-tagh. Two excursions made, for 150 miles, into the interior of the desert gave an insight into its physical features, flora and fauna. Moreover, before crossing the Gobi, the expedition explored in detail the remarkable Lukchun depression (in the south-east of Turfan), which was discovered by the brothers Grum-Grzimailo, and proved to be some 150 feet below the level of the ocean, although it is surrounded on all sides by high plateaus. Roborovsky established there a meteorological station, at which the barometer was observed for two consecutive years, and, accordingly, it may now be taken as certain that the surface of this depression is really from 150 to 300 feet below the sea-level.

Spending nearly one year in the Nan-shan highlands, the expedition has covered them with a whole network of surveys; so that when these surveys, as well as Obrucheff's researches are taken into account (as they are in a preliminary map appended to the *Izvestia* of the Russian Geographical Society), we see this region, almost entirely unknown three years ago, better explored now than many parts of Siberia. Where one ridge only was formerly drawn, we find on the new map a series of parallel ridges all running W.N.W. to E.S.E., intersected by high valleys, and attaining by their snow-clad peaks the heights of from 14,000 to 16,000 feet in the chains of Humboldt, Ritter, Da-sue-shan, and Alexander III.'s. The beginnings also have been made of a careful exploration of the Altyn-tagh, which was formerly known through Prjevalsky's and Littledale's journeys along its outer border.

It is pleasant to add that Roborovsky's health has much improved during the return journey, and that, on arriving in Russian Turkestan after a two years' absence, he could report "all well." The account of this journey will add several more important volumes to the scientific literature of Central Asia.

EVAPORATION.[1]

THE quantities of water added to the atmosphere daily by evaporation from the oceans and the continents constitute a fundamental consideration in meteorology; the quantities evaporated from cultivated fields, forests, and other forms of vegetation are equally important in agriculture, but as yet we have confessedly attained to only a very imperfect knowledge of this subject. Meteorologists have generally observed the amount evaporated from a small surface of water exposed either in the open air and sunshine, or else within such a shelter as is used for the open-air thermometer; lately a disc of moist paper has been substituted for the surface of water, as in the Piche evaporometer. Agriculturists, on the other hand, have made use of the lysimeter, which consists of a deep metallic box buried in the earth and having its open upper side flush with the surface of the ground. This box is filled with soil in which plants may or may not be growing, according to the object of the investigator. Record is kept of the amount of water or rain that is added to the lysimeter box from day to day, and also of the amount of water that drains from the bottom of the box. The difference between the two is adopted as the natural evaporation from the soil. The soil in the box may be kept very wet, to imitate a morass, or very dry to imitate a desert; the fineness of the soil may vary from coarse gravel to the finest silt.

If we desire the actual amount evaporated into the atmosphere, we must do more than record the results of the above forms of apparatus. The evaporating surface of water in the shaded thermometer shelter will indeed give up its moisture in proportion to the temperature of the water and to the velocity and dryness of the wind at its surface; but these three important factors have values so different out of doors from those within the shelter, that such records can, at the best, only give us a crude idea of the actual evaporation from surfaces in the open air. A great evaporation within the shelter, caused by a strong, hot, dry wind, may be accompanied by but little evaporation from the surrounding country if the latter be a desert of rock and gravel.

On the other hand, by means of the lysimeter, one may indeed determine directly the evaporation from soil of any character exposed to the natural outdoor conditions; but there then remains the difficult task of determining how much soil of each respective kind really occurs in the surrounding territory. In order, therefore, to determine the actual evaporation from land surfaces, one must observe a large number of lysimeters, and make an extensive minute survey of the country. The calculations incident to this latter method are very laborious.

The ordinary psychrometric observations give the dew-point or quantity of moisture in a small unit volume of air at any moment. If in the course of the day this quantity increases, we are not thereby warranted in concluding that the increase is due to a local evaporation; it may have been brought from a distance by the wind, or it may even have come down from the clouds as rain. If observations of dew-point are carefully made on all sides of a large field, over which a gentle wind is blowing, and if it should appear that there is a little more moisture in the air on the leeward side than on the windward side, one might conclude, provisionally, that this increase represented the quantity of moisture thrown by evaporation into the air as it gently moved over the surface of the field. But even this conclusion must be modified indefinitely by the consideration that in blowing across the field the wind does not move horizontally, but in a series of rolls and whirls by which the lower air in which we are observing becomes mixed with upper air, about whose moisture we know little or nothing.

In the midst of all these uncertainties it seems almost hopeless to attempt anything like an accurate determination of the moisture actually added to the atmosphere by evaporation from any extensive region of land or water; the question is far more complex than the determination of the evaporation from a reservoir of water, which latter problem is often attacked by the hydraulic engineers. Including the earth and its atmosphere in one comprehensive view, we may certainly say that the total annual evaporation from snow and ice, fresh water and salt water, must average the same as the total annual precipitation. We may even make an annual average for each continent, and say that the evaporation from the land plus the water that flows away in the rivers must equal the rainfall, and as the river discharge is frequently well known, we may, by subtraction, infer the evaporation. For the oceanic surface, on the other hand, the evaporation must equal the rainfall plus the river discharge from the continents.

The latest contribution to our knowledge of evaporation from land surfaces is published by Prof. E. Wollny, of Munich, at page 486, vol. xviii., of his "Forschungen." As the result of three years' continuous observations of five lysimeters and a neighbouring evaporometer, he concludes:

(1) That the quantity of moisture evaporated from the soil into the atmosphere is considerably smaller than that evaporated from a free surface of water.

(2) That the evaporation is smallest from naked sand, and largest from naked clay, whereas naked turf and humus or vegetable mould have a medium value.

(3) That the evaporation is increased to a considerable extent by covering the ground with living plants.

As the result of a minute analysis of the complex relations between the evaporation and the meteorological elements, on the one hand, and the physical features of the soil, on the other, Dr. Wollny further concludes as follows:

(4) Evaporation is a process that depends both upon the meteorological conditions and on the quantity of moisture contained by the substratum of soil.

(5) Among the external circumstances temperature is of the greatest importance, inasmuch as, in general, evaporation increases and diminishes with it; but this effect is modified according as the remaining factors come into play, and in proportion to the quantity of water supplied by the substratum.

(6) The influence of higher temperature is diminished, more or less, by higher relative humidity, greater cloudiness, feebler motion of the wind, and a diminished quantity of moisture within the soil, whereas its influence increases under opposite conditions. On the other hand, low temperatures can bring about greater effects than high temperatures if the air is dry, or the cloudiness small, or the wind very strong, or if a greater quantity of water is present within the evaporating substance.

(7) For the evaporation of a free surface of water, or for earth that is completely saturated with water, the important elements are—first the temperature, next the relative humidity

[1] Prof. Cleveland Abbe, in the U.S. *Monthly Weather Review*.

of the air, and then the cloudiness, direction and velocity of the wind; whereas, for the ordinary moist earth, no matter whether the surface is naked or covered with living plants, it is the quantity of rain upon which the soil depends for its moisture that is the important additional consideration. The effects of the external elements on evaporation become less important, as explained in paragraph 5, in proportion as the precipitation is less and as the soil is more completely dried out by the previous favourable weather, and *vice versa*. For these reasons the rate of evaporation from a free surface of water not infrequently differs largely from that from the respective kinds of soil.

(8) Free surfaces of water, and soils that are continuously saturated, evaporate into the atmosphere on the average more water under otherwise similar circumstances than soils, whether naked or covered with plants, and whether watered artificially or naturally. Only at special times, viz. when the influence of the factors that favour evaporation is most intense, when the plants are in the most active period of growth, and when the soil contains a large percentage of water, can the land that is covered with plants show a larger evaporating power than the free-water surface.

(9) When a soil that is not irrigated is covered with plants, it evaporates a far greater quantity of moisture than when the surface is bare. In the former case the evaporation can not exceed the quantity received by the soil from the atmosphere before or during the period of growth. Swampy lands and those that are well irrigated, as also free surfaces of water, can, under circumstances favourable to evaporation, sometimes give to the atmosphere a greater quantity of water than corresponds to the precipitation that occurs during the same time.

(10) The evaporating power of the soil is, in itself, dependent upon its own physical properties; the less its permeability for water, or the larger its capacity for water and the easier it is able to restore by capillarity the moisture that has been lost, by so much the more intensive is the evaporation. For this reason the quantity evaporated increases with the percentage of clay and humus in the soil, whereas it diminishes in proportion as the soil is richer in sandy and coarse-grained materials.

(11) Soil that is covered with plants loses by evaporation so much more water in proportion as the plants are better developed, or stand thicker together, or have a longer period of vegetation, and *vice versa*.

In conclusion, Wollny repeats that the use of apparatus giving the total evaporation from free-water surfaces does not respond to the needs of the agriculturist [and we may add of the meteorologist], but that instruments must be used for measuring the evaporation from masses of earth that are wet with rainfall only, and free from stagnant wet soils. Lysimeters are recommended having a section of one-tenth of a square metre and a depth of soil one-half of a meter, and set out in the open air, sunk flush with the surface of the ground, and arranged so as to be easily weighed at any moment, and so that the drainage water can easily be measured.

The foregoing results of Wollny's laborious observations confirm us in the general conclusion that the quantity of water actually evaporated from a large surface of land, such as a definite watershed maintaining a single river, can only be determined by the following considerations. The quantity of water contained in the soil at the end of any given period in excess of what it contained at the beginning, plus the water that is carried off by drainage and river flow, plus whatever is evaporated into the atmosphere either directly or through the crops and forests, must equal the rain and irrigation water added to the soil during that time. As the soil content of water, the riverflow and drainage, and the rainfall can be severally determined by direct observation far better than the evaporation, the latter is to be determined by taking the difference between the rainfall and all other sources of loss or consumption.

LONDON UNIVERSITY COMMISSION BILL.

REFERENCE was made in our issue of July 9, to the Bill introduced by the Duke of Devonshire in the House of Lords, for the purpose of appointing a statutory Commission to make further provision with respect to the University of London. The Bill reads as follows:—

Whereas the Commissioners appointed to consider the draft charter for the proposed Gresham University in London, have by their report made recommendations with respect to the reconstitution of the University of London, and to the appointment of a statutory Commission for that purpose:

Be it therefore enacted by the Queen's most Excellent Majesty, by and with the advice and consent of the Lords Spiritual and Temporal, and Commons, in this present Parliament assembled, and by the authority of the same, as follows:—

I. *Appointment of Commissioners.*—(1) There shall be a body of Commissioners styled the University of London Commissioners, and consisting in the first instance of the following persons [names not yet announced].

(2) If and whenever any vacancy occurs among the Commissioners, it shall be lawful for Her Majesty the Queen to appoint a person to fill the vacancy; but the name of every person so appointed shall be laid as soon as may be before both Houses of Parliament.

(3) The Commissioners may, with the consent of the Treasury as to number, appoint or employ such persons as they may think necessary for the execution of their duties under this Act, and may remove any person so appointed or employed.

(4) There shall be paid to any person so appointed or employed such remuneration as the Treasury may assign, and that remuneration and all expenses of the Commissioners incurred with the sanction of the Treasury in the execution of this Act shall be paid out of moneys provided by Parliament.

II. *Duration and proceedings of Commissioners.*—(1) The powers of the Commissioners shall continue until the end of the year one thousand eight hundred and ninety-seven, and no longer; but it shall be lawful for Her Majesty the Queen, from time to time, with the advice of Her Privy Council, on the application of the Commissioners, to continue the powers of the Commissioners for such time as Her Majesty thinks fit, but not beyond the end of the year one thousand eight hundred and ninety-eight.

(2) The Commissioner first named in this Act shall be the Chairman of the Commissioners; and in case of his ceasing from any cause to be a Commissioner, or of his absence from any meeting, the Commissioners present at each meeting shall choose a chairman.

(3) The powers of the Commissioners may be exercised at a meeting at which three or more Commissioners are present.

(4) In case of an equality of votes on a question at a meeting, the chairman of the meeting shall have a second or casting vote in respect of that question.

(5) The Commissioners shall have a common seal which shall be judicially noticed.

(6) Any act of the Commissioners shall not be invalid by reason only of any vacancy in their body; but if at any time, and as long as, the number of persons acting as Commissioners is less than four, the Commissioners shall discontinue the exercise of their powers.

III. *Powers and duties of Commissioners.*—(1) The Commissioners shall make statutes and regulations for the University of London in general accordance with the scheme of the report hereinbefore referred to, but subject to any modifications which may appear to them expedient after considering any representations made to them by the Senate or Convocation of the University of London, or by any other body or persons affected.

(2) In framing such statutes and regulations, the Commissioners shall see that provision is made for securing adequately the interests of collegiate and non-collegiate students respectively.

(3) Statutes and regulations made under this Act shall have effect notwithstanding anything in any Act of Parliament, charter, deed, or other instrument.

IV. *Approval of statutes and regulations.*—(1) When any statute or regulation has been made by the Commissioners, a notice of its having been made, and of the place where copies of it can be obtained, shall be published in the *London Gazette*, and the statute or regulation shall be laid as soon as may be before both Houses of Parliament, and shall not be valid until it has been approved by Her Majesty the Queen in Council.

(2) If either House of Parliament within forty days, exclusive of any period of prorogation, after a statute or regulation has been laid before it, presents an address praying the Queen to withhold her assent from the statute or regulation, or any part thereof, no further proceedings shall be taken on the statute or regulation, or on the part thereof to which the address relates, but this provision shall be without prejudice to the making of a new statute or regulation.

(3) The Senate or Convocation of the University of London, or any other person or body directly affected by any such statute or regulation, may, within thirty days after the notification thereof in the *London Gazette*, petition Her Majesty in Council to withhold her approval of the whole or any part thereof.

(4) Her Majesty in Council may refer any such petition to a committee of the Privy Council, with a direction that the committee hear the petitioner personally or by counsel, and report specially to Her Majesty in Council on the matter of the petition.

(5) Thereupon it shall be lawful for Her Majesty by Order in Council either to declare her approval of the statute or regulation in whole or in part, or to signify her disapproval thereof in whole or in part. but any such disapproval shall be without prejudice to the making of a new statute or regulation.

(6) The costs of any petition under this section may be regulated by the committee to which the petition is referred.

V. *Power to amend statutes and regulations.*—After the expiration of the powers of the Commissioners the Senate of the University shall have power to make statutes and regulations for altering or supplementing any of the statutes or regulations made by the Commissioners. Provided as follows:—

(1) A statute made under this section shall be subject to the provisions of the last foregoing section, with the substitution only of the Senate for the Commissioners;

(2) A regulation made under this section shall be invalid so far as it is inconsistent with any statute made under this Act and for the time being in force.

VI. *Short title.*—This Act may be cited as the University of London Act, 1896.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

A DESPATCH (says the *Board of Trade Journal*) has been received at the Foreign Office from Mr. Martin Gosselin, Her Majesty's Chargé d'Affaires at Berlin, stating that a Government chemical dyeing school has recently been opened at Crefeld, which has cost about £20,000, exclusive of the machinery and fabrics, which have for the most part been presented by private manufacturers. The school contains laboratories for research and educational purposes, as well as a complete collection of dyeing machinery, and an exhibition showing the result of different processes.

THE following are among recent announcements:—Dr. Franz Boas to be lecturer on physical anthropology in Columbia University; Dr. Arthur Allen to be professor of psychology and pedagogy in the Ohio University; Dr. Bauer, professor of mineralogy at Marburg, to be Privy Councillor; Dr. H. Biltz to be extraordinary professor of chemistry at Greifswald; Dr. Linde, professor of physics in the Munich Technical High School, to be Ph.D. *honoris causa* of Göttingen University.

PLANS have been filed for the buildings of Barnard College in New York City. Three halls have been provided for. The central one is named Milbank Hall, in honour of the donor, Mrs. Anderson, *née* Milbank, and will cost 160,000 dols. Opposite the grounds of Columbia University will be Brinkerhoff Hall, costing 132,000 dols., the gift of Mrs. Brinkerhoff. The third hall for which the plan provides will correspond to Brinkerhoff Hall. Funds are not yet provided for it, nor a name assigned.

SCIENTIFIC SERIALS.

American Journal of Science, July.—Lecture experiment with liquid carbon dioxide, by C. Barus. The passage from the liquid into the gaseous state should be shown in full daylight, the tube containing the liquid being placed vertically in a wooden trough closed by plate-glass at both ends. This insures safety, and gives more light than a water-bath. The image of the tube is thrown upon a screen. Two different focal lines are obtained, one for the gas, the other for the liquid. Contrary to what might be expected, the one does not pass continuously into the other, that for the gas being always virtual, and that for the liquid real.—Percussion figures on cleavage plates of mica, by T. L. Walker. These figures, produced by a blow on the centre of a hexagonal plate with a blunt needle, have been described as being six-rayed stars with the rays at 60° to each other. Accurate measurements show that the angles may vary from 53° to over 63°, according to the kind of mica employed.—The seven-day weather period, by H. Helm Clayton. To extend the investigation of the seven-day weather period beyond the area of the United States, three stations were selected in the Arctic region, five in Europe, two in Asia, two in Oceania near the equator, three in middle South America, one in Mauritius, and one in Australia. The periods investigated were those of 7 days 6·43 hours, 6 days 3·95 hours, and 5 days 10·8 hours. Particular attention was given to a compilation of barometric minima at these stations during the last fifteen years. The results show that, on the average, twice in a period of 7 days 6·43 hours in America, and three times in Europe, waves of barometric minima, or storms, tend to begin near the poles, and sweep across the continents. There is a tendency at every station for the days of maximum frequency to remain on the same days of the period throughout the year.—The hydrology of the Mississippi, by J. L. Greenleaf. This is a valuable and interesting paper dealing with the drainage areas, rates of flow, and rainfall over the tributaries of the great American river. It is illustrated by diagrams representing the various factors in a concise and lucid manner. The largest drainage area is that of the Missouri. Then follows the Ohio, the Arkansas, and the Red River. Of these, the Missouri has the most striking peculiarities. Its drainage area has an average rainfall of 19·6 inches per annum. Although in flood it is a mighty torrent, its average volume is very poor considering its enormous drainage area of 527,700 square miles. Only 12 per cent. of the rainfall finds its way into the river. The rest is absorbed and evaporated by the extensive prairies. In the Ohio area the proportion is 30 per cent., and since the annual rainfall is 43 inches, it is not surprising that its discharge exceeds that of the Missouri. Near the Mexican Gulf we have the Yazoo and St. Francis Rivers, which carry off 70 per cent. of their rainfall, owing to its being quickly absorbed by the sandy soil, or stored in the swamps. There are other admirable diagrams showing the growing volume of water as each tributary enters, and giving the whole life-history of the river system in a very attractive shape.

Wiedemann's Annalen der Physik und Chemie, No. 6.—Electrolysis of water, by A. P. Sokolow. Helmholtz applied his theorem of free energy in thermodynamics to electrolysis, and concluded that the E.M.F. necessary to electrolyse water depends upon the density of the hydrogen and oxygen at the electrodes, and that when the liquid is free from gas the necessary E.M.F. may closely approximate to zero. The author endeavoured to find a more rigorous experimental proof of this conclusion than has hitherto been obtained. This was done by constructing a voltameter with platinum electrodes in which separate platinum wires were fused in close to the electrodes. Any polarisation of the latter due to a current, if leading to the formation of gas, would be gradually transferred to the wires through the separating liquid. This was found to be the case, and dissociation was obtained with E.M.F.s of a few hundredths of a volt.—Loss of energy in magnetisation by oscillatory condenser discharges, by Ignatz Klemenčič. Hysteresis and other losses have so far only been investigated with about a hundred oscillations per second. The author experimented with condenser discharges up to 2000 per second in order to obtain an approximate idea of the action of Foucault currents and hysteresis in iron and nickel at higher frequencies. The method used was that of discharging a condenser and interrupting its discharge at a certain stage by a dropping weight. This made it possible to determine the damping of the oscillations in a simple coil and in a coil with an iron or nickel core respectively. The results showed that even in thin iron wires the loss of energy was chiefly determined by the Foucault currents. The losses due to hysteresis in soft iron were considerably greater than those calculated from the hysteresis curves at lower frequencies. For steel and nickel, however, the losses were about the same.—On magnetic irregularity and the annealing of iron and steel, by A. Ebeling and E. Schmidt. Annealing, if done uniformly, may be sometimes useful; but if not uniform, it may be detrimental to magnetic homogeneity. The most uniform material is obtained by careful fusion. Wrought iron is not made magnetically uniform by annealing.—Transparency of bodies for Röntgen rays, by O. Zoth. This was determined by comparing them with a tinfoil scale containing grades of various thicknesses. The transparency of alcohol compared with tin was 600, that of water 300, cork 2450, ebonite 150, plate-glass 29, magnesium 36,

aluminium 25, lead 0·29, gold 0·28, and platinum 0·25. The author also found a slight difference between the transparency of solid substances and their powders, which shows that there is some reflection or refraction. Loose powder was even less transparent than pressed powder.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, May 21.—"Note on the Larva and Post-larval Development of *Leucosolenia variabilis* H. sp., with Remarks on the Development of other Asconidæ." By E. A. Minchin.

The larva of *Leucosolenia variabilis* is an amphiblastula of a primitive type, transitional in many respects between the larva of the lower Ascons and the amphiblastula of the Sycons. It has an anterior ciliated, and a posterior non-ciliated pole, but when first hatched the ciliated pole is relatively very large, and the non-ciliated cells are few in number. During the free-swimming larval period the non-ciliated cells increase through their numbers being recruited from the ciliated cells, of which those situated more posteriorly become modified into granular cells after passing through an intermediate stage. In addition to anterior ciliated cells, posterior granular cells, and the equatorial zone of intermediate cells, the larva has cells of a fourth kind, placed in the centre of the body, immediately behind the minute central cavity, which contains gelatinous matter and is surrounded laterally by a ring of pigment lodged in the inner ends of the ciliated and intermediate cells. The central cells, together with the pigment, appear to constitute a larval organ, perhaps sensitive to light, which is lost at the metamorphosis.

The larva swims for 36-48 hours and fixes by the anterior pole. The granular cells grow round the ciliated cells, and the former become the dermal layer, the latter the gastral layer. At first the dermal layer forms an epithelium of a single layer, which becomes two-layered by immigration of certain of its cells. The dermal cells which remain on the surface secrete each a single monaxon spicule; those which migrate inwards arrange themselves into groups, and secrete the tri- and quadri-radiate spicules. While these changes are taking place in the dermal layer, a central cavity has appeared, round which the gastral cells arrange themselves in a columnar epithelium and gradually assume the characters of collar cells. At one spot the cavity is not lined by gastral cells, but by dermal cells only; it is here that the osculum is formed about the sixth day of fixation.

In the other Ascons investigated—*L. cerebrum*, *L. coriacea*, and *L. reticulum*—the larvæ are oval ciliated blastulæ in which an inner mass of cells is formed by modification and subsequent immigration of certain of the ciliated cells. In *cerebrum* and *coriacea* the immigration appears to be multipolar; in *reticulum* it takes place from the posterior pole, and thus affords a transition to the above-described larva of *variabilis*. If the cavity of the larva of *reticulum* be imagined reduced to the extent to which this has occurred in *variabilis*, then the modified cells at the hinder pole, instead of migrating inwards, must remain where they are, and as more ciliated cells become modified around them, a type of larva is obtained with ciliated cells anteriorly, intermediate cells laterally, and non-ciliated cells posteriorly, as in *variabilis*. This homology is further borne out by the fact that in all these larvæ the inner mass becomes the dermal layer, and the ciliated cells become the gastral layer, as the result of changes in position which take place at the metamorphosis. The post-larval development of the layers is similar to that described for *variabilis*.

When the development of *L. variabilis* is compared with that of Sycon as described by Schulze and Metschnikoff, it is seen that the only difference between them lies in the periods at which the events take place. In Sycon the larva, while still in the maternal tissues, undergoes changes which in *variabilis* take place during the free swimming period, and the dermal cells surround the gastral cells before fixation in Sycon, instead of after fixation, as in *variabilis*.

The primitive larva of Calcarea was probably a ciliated blastula, in which an inner mass, the future dermal layer, was formed by modification and immigration of certain of the cells.

The immigration of cells from the dermal layer to form the triradiate spicules is precisely similar to what occurs in the adult whenever new spicules arise. Hence this process is not to be regarded as one of blastogenetic, but of histogenetic significance. In other words, sponges are to be regarded as two-layered animals, and not as possessing a mesoderm.

June 18.—"On Fertilisation, and the Segmentation of the Spore, in *Fucus*. By Prof. J. Bretland Farmer and Mr. J. Ll. Williams.

An account was given of an investigation into the mode of formation of the oospheres, of their fertilisation by the antherozoids, and of the germination of the resulting spores in various members of the Fucaceæ, special attention being paid to the protoplasmic structures therein concerned. The chief points were illustrated by lantern-slides from photomicrographs.

In order to study the fertilisation and germination stages, diœcious species were selected, and the male and female plants were kept in separate dishes, covered over so as to prevent drying up. This method gave far better results than those more usually advocated. On the appearance of the extruded sexual products, the female receptacles were placed in sea water, and after the complete liberation of the oospheres, a few male branches with ripe antherozoids were first placed in a capsule of sea water until it became turbid owing to their number. If on examination the antherozoids proved to be active, small quantities were added to the vessels containing the oospheres. The latter were then fixed at intervals of five minutes during the first hour, and then at intervals of fifteen minutes, up to six hours after the addition of the antherozoids. After that, samples were killed at longer intervals up to three days, and this was continued till we had material fixed at all stages for the first fortnight. At first sea water was used in which to keep the embryos growing, but a proper solution of Tidman's sea salt was found to answer quite as well. A large number of fixing reagents were tried, but Flemming's solution diluted with sea water gave the best results. Many reagents in common use proved utterly worthless. In embedding the tissues and spores in paraffin, previous to cutting them, it is important not to allow the temperature to rise above 50° C.

When an oogonial nucleus is about to divide, it first becomes slightly, then very much, elongated so as to resemble an ellipse. Fine radiations are seen to extend from the two ends into the surrounding cytoplasm. The latter is at first tolerably uniformly granular, but as the radiations around the polar areas increase, these regions become cleared altogether of the granules which then become massed outside them. The nucleus rapidly becomes more spindle-shaped, and its chromatic elements are chiefly grouped near each pole, leaving a clear space about the equator in which the nucleolus is situated.

The polar radiations continue to increase and the nucleus to lengthen, until the entire structure recalls the figure of a dumb-bell, in which the nucleus answers to the handle, and the radiation areas to the knobs. If the radii be traced outwardly, they are seen to terminate either in the frothy protoplasm, on the angles where the foam walls meet, or on the large granules which surround the cleared areas and are embedded in the foam. No structures were seen which could *certainly* be identified as centrosomes, although bodies suggestive of them were often observed; but these proved to be so variable in size and position, as well as in number, that it appeared impossible to attach any special significance to them.

The achromatic spindle is remarkable, inasmuch as it is intranuclear. The chromosomes were too minute to admit of their development being satisfactorily studied, but in all the *oogonial* spindles the number was estimated as *ten* when seen in profile. After the delimitation of the oospheres, some of them were observed to contain more than one nucleus. This is an abnormal feature, and the non-recognition of this fact has led to mistaken views in the past. When the oospheres are extruded, and come to lie free in the water, they swell somewhat, and are turbid with granules, which are very abundant in the cytoplasm. About five minutes after the mixing of the sexual cells, the antherozoids are found to have slipped into many of the oospheres. The act of penetration was not observed, but, in a number of cases, the antherozoid could be recognised within the oosphere, before its final fusion with the nucleus of the latter. It is a roundish, densely staining body, and, unlike the majority of animal sperm cells as yet described, no system of radiations are associated with it when in the egg. Judging from the short period of time elapsing between its penetration of the surface of the oosphere and its arrival at the exterior of the female nucleus, it must pass through the intervening cytoplasm with great rapidity. It then becomes closely appressed to the nucleus,

and is about as large as the nucleolus of the latter. It rapidly spreads over a part of the female nucleus as a cap, and it presents a less homogeneous aspect than before. Both it and the female nucleus assume a granular character, which is probably to be interpreted as representing a coiling and looping of the linin of the respective nuclei. Finally the two nuclei coalesce, and the original components can no longer be distinguished. Complete fusion may be effected in less than ten minutes after the addition of the antherozoids to the water.

A delicate pellicle is meanwhile formed around the periphery of the oosphere, which is thus easily distinguished from the unfertilised oospheres, in which such a membrane is wanting. The texture of the cytoplasm also changes, and tends to assume a more definitely radiating character, the lines starting from the nucleus as a centre.

After fertilisation, the cells rest for a long interval of time—commonly about twenty-four hours—before they begin to segment. The principal changes which occur during the interval are, first, in the rapid increase in the thickness of the peripheral cell wall, and, secondly, in the more regular arrangement of structure exhibited by the protoplasm. The alveolar or foam character is extremely clear, and the chromatophores, which by this time have become very prominent, are noticed to be situated in the angles formed by the convergence of the foam walls; they are often bent and otherwise distorted, and so accommodate themselves to the structural condition of the foam.

The first segmentation-division resembles, in a general way, the oogonial nuclear divisions already described. The achromatic fibrils forming the polar radiations are clearly seen to be attached to the foam-like structure of the cytoplasm, and, in some cases, insensibly to pass into it. At other times fibrils end on granules (or, perhaps, on the protoplasmic lining of the granules), and sometimes again a fibril may fork, and its branches end either on granules or on the foam angles. The interpolar portion of the spindle is intranuclear, and the chromosomes, when arrayed at its equator, are seen to be *twice as numerous* as those in the oogonial spindles. This doubled number is maintained throughout the thallus divisions, and the reduction in their number only occurs in connection with the actual differentiation of the sexual cells. The theoretical conclusions to be drawn from these facts were briefly indicated by the authors.

"Phenomena resulting from Interruption of Afferent and Efferent Tracts of the Cerebellum." By Dr. J. S. Risien Russell, Research Scholar to the British Medical Association.

Continuing his researches into the functions of the cerebellum, the author has directed his attention to the effects of dividing one inferior peduncle of this organ. He finds that in the disorders of equilibration which result, the direction of rotation is towards the side of the lesion, or, in other words, if, as was always the case, the left peduncle was divided, the animal rotated like a right-handed screw entering an object.

The disorders of motility which result from such a lesion correspond exactly with those observed after ablation of one lateral half of the organ, and consist in defective movement in the limbs on the side of the divided peduncle, and of the posterior limb of the opposite side. It is suggested that these effects may result from the interruption of afferent impulses passing to the cerebellum, rather than from the cutting off of efferent impulses from the cerebellum to the spinal centres. The interruption of similar impulses are held responsible for the displacement of both eyes downwards and to the opposite, a displacement which also resulted after removal of one lateral half of the cerebellum.

Spasm, which was easily detected in the back and neck muscles on the side of the lesion, causing incurvation of the vertebral axis to that side, alone furnished any satisfactory information in support of the view that the cerebellum exerts an inhibiting influence on the spinal centres; but the tendon reflexes afforded no satisfactory information on this point.

Sensibility was blunted on those extremities in which motor power was defective, a point in favour of the author's previous contention that the cerebellum is concerned with sensory as well as with motor processes.

The excitability of the cortex of the opposite cerebral hemisphere to the Faradic current was less than that of the hemisphere on the same side as the divided peduncle, a result which strengthens the view that one lateral half of the cerebellum exerts a control on the opposite cerebral cortex, as was suggested by certain results previously obtained by the author, and which further points to the possibility that the cerebellum is in its turn inhibited by afferent influences which reach it from lower centres. This view is made still more probable by the remarkable results obtained by the intravenous injection of absinthe after division of one inferior peduncle of the cerebellum, for during the otherwise general convulsions which resulted, there was a complete absence of convulsions in the muscles of the anterior extremity on the side of the lesion, and a diminution of the convulsions in the muscles of the posterior extremity of the same side.

These results were supplemented and controlled by other experiments in which the lateral tracts of the medulla oblongata were divided on one side without injury to the pyramid, by others in which the posterior columns and their nuclei were divided on one side, and by others in which partial hemisection of the medulla was performed, including all the structures on one side with the exception of the pyramid.

PARIS.

Academy of Sciences, July 13.—M. A. Chatin in the chair.—On the flow of liquids in large rectangular channels, and in pipes or canals of circular or semicircular section, by M. J. Boussinesq.—On the law of corresponding states of Van der Waals, and the determination of the critical constants, by M. E. H. Amagat. Some applications of the method of projection described in a previous note. Taking the critical constants of any one substance, the determination of which may be looked upon as the most trustworthy, the critical constants of any other substance may be determined in terms of these from the experimental pv curve.—On a new method for the determination of the respective distances of the centres of cerebral localisation, by M. C. Henry.—Remarks, by M. Langlois, on a new theory of capillarity.—On the fixing of photographs in colour on paper, by M. A. Graby.—Aërial navigation, by M. L. Gardère.—On differential equations of the first order, by M. P. Painlevé. A reply to a note of M. Korkine.—On groups of substitutions, by M. G. A. Miller.—On the function $\zeta(s)$, by M. Hadamard. Pointing out that a part of a proof given in a preceding note is not rigorously true.—On the displacement of the axis of rotation of a solid body of which a part is rendered instantaneously mobile with respect to the rest of the mass, by MM. Edmond and Maurice Fouché.—On the elastic equilibrium of a revolving body, by M. L. Lecornu.—On a graphical representation of luminous waves, by M. G. Vert.—On the verification of the theorem of corresponding states, by M. C. Raveau. By taking the logarithms of pv and p as co-ordinates, instead of pv and p, the method suggested by M. Amagat is much simplified in its application.—On an absolutely astatic galvanometer of high sensibility, by M. A. Broca.—On the vaporisation of metals at the ordinary temperature, by M. H. Pellat. Results similar to those obtained by M. Colson with zinc are obtainable with steel. In view of the experiments of M. Becquerel with metallic uranium, it is suggested that similar invisible radiations, and not the vapour of the metal, may produce the effects observed.—Method for photographing in reverse, objects in relief, by M. E. Moussard.—On the manner in which the X-rays cause the discharge of electrified bodies, by M. Émile Villari. Some experiments tending to show that the discharge is due to convection currents in the air surrounding the charged body.—The action of tubes and metallic discs upon the X-rays, by the same.—The action of the Röntgen rays on the diphtheric bacillus, by M. F. Berton. No attenuation of the virus could be obtained by exposure to the rays for forty-eight hours.—On the fusibility of metallic alloys, by M. Henri Gautier. A study of the fusibility curves allows of the prediction of the existence of the following alloys of definite composition: Ni_3Sn_2, SnAl, Ag_3Al, and SbAl, the last of which was isolated by C. Alder Wright.—Diamonds in steel, by M. Rossel.—Action of silicon upon certain metals, by M. E. Vigouroux. The alkali metals, zinc, aluminium, lead, tin, antimony, bismuth, gold and silver dissolve silicon more or less, but do not combine with it directly. Iron, chromium, nickel, cobalt, manganese, copper and platinum, on the other hand, form definite silicides.—Researches on the double cyanides, by M. R. Varet.—Action of water upon formic aldehyde, by M. Marcel Delépine. Formic aldehyde with water at 200° gives CO, CO_2, formic acid and methyl alcohol.—Reduction of crotonic aldehyde, by M. E. Charon. By the use of the

zinc-copper couple in acetic acid solution two unsaturated alcohols are obtained:

$$CH_3.CH : CH.CH_2OH$$

and

$$CH_3.CH : CH.CH(OH).CH(OH)CH : CH.CH_3.$$

—Rapid estimation of carbon dioxide in the air and confined spaces, by M. Henriet. The gas is absorbed in potash, and the latter titrated with sulphuric acid, using phenol-phthaleïn as indicator.—Termination of the muscular sensory nerves on the striated bundles, by M. C. Rouget.—On the electroneuro-muscular circuit, by M. E. Solvay.—Cutaneous evaporation in the rabbit. Modifications under the influence of electrical excitement, by M. Lecercle. Under the influence of galvanisation the cutaneous evaporation is increased.—On the order of succession of the fauna of the Upper Lias near Luçon, by MM. Chartron and Welsch.—On the topaz crystals of Perak, by MM. A. Lacroix and Sol.—On the estimation of gluten in flour, by M. Balland.—On the treatment of such diseases as gout and diabetes by high frequency currents, by M. Vigouroux.—On the results furnished by orchitine in the treatment of leprosy, by M. Bouffé.

PHILADELPHIA.

Academy of Natural Sciences, June 23.—Rev. H. C. McCook reported a series of observations on the California trap-door spider, *Cteniza Californica*, made by Dr. Davidson, who has been able to determine the time required for the construction of the burrow in confinement, and other matters connected with the life-history of the animal. It has taken ten hours to construct the nest with its hinged door, another spider having made a hole large enough to conceal itself in two hours. The method of digging was the same in the main as that described by Dr. McCook for the tarantula. The young, when they emerge, at once build their own miniature nests, which are renewed every spring until they reach the full size. Based on the study of a Lycosid, the speaker had predicted that the enemy of the trap-door spider would be found to be a diurnal wasp. Dr. Davidson had established the fact that such is the case, and that the attacking species is *Parapompilus planatus*, Fox.—Mr. H. C. Mercer made a report on his recent exploration of certain caves in Tennessee, which he had been able to prosecute under the patronage of the University of Pennsylvania, mainly through the liberality of Dr. William Pepper. In Zirkel's cave on Dumpling Creek, Jefferson County, Tennessee, crusts of breccia projected from the walls and hung from the roof. From this material the teeth of the tapir, peccary, &c., projected, while in the cave below were found bones, nuts, two pieces of Indian pottery and fragments of mica, probably indicating Indian burial cave. There were therefore two ages indicated: one ancient, by the breccia, and the other, the cave earth, comparatively recent. All the fossil remains belonged to the breccia, and there was no association between them and the indications of human life. Another cave on the Tennessee River, under Lookout Mountain, Hamilton County, Tennessee, presented a floor of two layers, the black top one, of three or three and a half feet in thickness, composed of Indian remains, and another of yellow earth containing a few animal remains but no indication of human existence. Mylodon and Tapirus fragments, found some time ago close to the bottom of the upper layer, had probably been scraped up from the lower. Neither, therefore, did this cave present any certain data for the advancement of the date of man's antiquity. On the contrary, the evidence supported the belief that pleistocene or palæolithic man had not existed in that region. On penetrating the forbidden entrance of Big Bone Cave, near Caney Fork River, Van Buren County, Tennessee, he had found, nine hundred feet in, the bones of *Megalonyx* still bearing articular cartilages. Fragments of torches were found beneath the sloth bones, probably buried by burrowing rats. Prof. E. D. Cope commented on the fossil bones collected in the caves described by Mr. Mercer. The presence of cartilages on the *Megalonyx* bones indicated for them an age certainly not more remote than the existence of man on this continent. Other bones belonging to young individuals were larger than corresponding ones found at Port Kennedy, indicating the validity of the two species: *Megalonyx Wheatleyi* and *M. Jeffersonii*. Mr. Mercer had also collected remains of fifteen or twenty species of birds, six fishes, one batrachian, four tortoises, one rattlesnake, and nineteen mammals. The special value of Mr. Mercer's careful work was commented on. The peccary is found in Zirkel's cave, although no trace of it appears in the Lookout Mountain cave. Several undescribed species were indicated.

BOOKS, PAMPHLETS, and SERIALS RECEIVED.

BOOKS.—Catalogue of the Fossil Bryozoa in the Department of Geology (Natural History): Dr. J. W. Gregory: The Jurassic Bryozoa (London).—Glasgow and West of Scotland Technical College, Calendar for the Session 1896-7 (Glasgow).—The Biological Problem of To-day: Dr. O. Hertwig, translated by P. C. Mitchell (Heinemann).—Die Formen der Familie und die Formen der Wirthschaft: E. Grosse (Freiburg, Mohr).

PAMPHLETS.—Tesi de Fisica e Meccanica: G. Casazza (Milano).—Field Columbian Museum, Annual Report for the Year 1894-95 (Chicago).—Fiftieth Annual Report of the Director of the Astronomical Observatory of Harvard College: E. C. Pickering (Cambridge, Mass.).—Die Saturniiden; A. R. Grote (Hildesheim).

SERIALS.—Records of the Geological Survey of India, Vol. xxix. Part 2 (Calcutta).—Indian Museum Notes, Vol. 3, No. 6; Vol. 4, No. 1 (Calcutta).—Science Progress, July (Scientific Press).—Journal of the Royal Microscopical Society, June (Williams).—Annals of the Astronomical Observatory of Harvard College, Vol. xl. Part 4; Vol. xli. No. 3; Vol. xxxiv. (Cambridge, Mass.).—Journal of the Academy of Natural Sciences of Philadelphia, 2nd series, Vol. x. Part 3 (Philadelphia).—Lloyd's Natural History. Cats, Civets, and Mungooses: R. Lydekker, Part 1 (Lloyd).—Psychological Review, July (Macmillan).—Bulletin de l'Académie Royale des Sciences de Belgique, 1896, No. 5 (Bruxelles).—Journal of the Royal Statistical Society, June (Stanford).—Journal of the Franklin Institute, July (Philadelphia).—American Journal of Science, July (New Haven).—American Naturalist, July (Philadelphia).—Zeitschrift für Wissenschaftliche Zoologie, lvi. Band, 3 Heft (Leipzig, Engelmann).—Strand Magazine, July (Newnes).—Quarterly Review, July (Murray).—Proceedings of the Physical Society, Vol. 14, Part 7 (Taylor).—Lean's Royal Navy List, July (Witherby).—Engineering Magazine, July (Tucker).—Annales de l'Observatoire Astronomique de Moscou, deux série Vol. 3, Livr. 2 (Moscou).—Journal of Anatomy and Physiology, July (Griffin).—Bulletin of the American Mathematical Society, June (New York, Macmillan).—Memorie della Società Geografica Italiana, Vol. vi. Parte Prima (Roma).—Lloyd's Natural History. Cats, &c.: R. Lydekker, Part 2 (Lloyd).—Zeitschrift für Physikalische Chemie, xx. Band, 2 Heft (Leipzig, Engelmann).—Transactions of the Royal Society of Edinburgh, Vol. xxxvii. Parts 3 and 4; Ditto, Vol. xxxviii. Parts 1 and 2 (Edinburgh, Grant).—Proceedings of the Royal Society of Edinburgh, Vol. xxi. No. 1 (Edinburgh).—Archives of Clinical Skiagraphy, No. 2, Vol. 1 (Rebman).

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